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THE GENUS *NEONEURA* (ODONATA)

BY E. B. WILLIAMSON

The present paper is the outcome of an effort to identify material collected in Guatemala, British Guiana and Trinidad by B. J. Rainey, L. A. Williamson and myself. When Dr. Calvert learned I was studying this material he kindly offered me material and notes collected by himself in Costa Rica, informing me that his material included one probably new species. This species proved to be the same as one we had collected in Trinidad, and it is described and named in this paper. Through the good offices of Dr. Ris, I obtained drawings from M. Menger of species in the de Selys collection. Unfortunately since de Selys' work was done, the *Neoneura* specimens in his collection have been greatly damaged, and only a limited number could be figured. I have also, through the kindness of Dr. Calvert, Mr. Kahl, Dr. Henshaw and Professor Needham, been able to study the *Neoneuræ* in the several collections in their charge, so that I know at first hand all the species but *waltheri* and *rufithorax*, neither of which, most unfortunately, Menger could figure. The figures of appendages and thoracic patterns which accompany this paper, except where otherwise indicated, have been made by Mr. Kennedy, whose aid is gratefully acknowledged. The wing photographs were kindly made for me by Mr. Munz.

De Selys' separation of *Neoneura* into two groups on the basis of abdominal coloration served some purpose in identifying material, but gives no hint of relationships, since some of the closest allies are thereby separated. Real relationships are indicated, I believe, by the male appendages, and, to a lesser extent, by female thoracic color patterns and prothoracic hind lobes, but the females of several species are not known at this time. My ideas of relationships are indicated in the key to males and the sequence of species in the text.

The most valuable specific characters are found in the male appendages and the prothoracic hind lobes of the females. In the latter case it must be noticed that in those species in which lateral developments of this border occur, these developments are

usually relatively weakly chitinized and some variation or post-mortem distortion must be looked for. The superior appendages of the male are involved, the inferiors simple. A real comprehension of the form of the superior can come only after prolonged study in many views with a binocular microscope. Throughout the genus the parts may be homologized in all the species. The external face of the superior is divided more or less distinctly into two parts, the lower part usually the smaller and simpler, consisting generally of a more or less horizontal plate, the outer angle of which (alone seen in profile view) is commonly better developed than the inner angle, which is ordinarily acute, black-tipped and resting against the inferior appendage. The upper branch of the superior consists of a more or less expanded plate, with a generally interno-dorso-posteriorly directed surface. The dorsal edge of this plate varies in different species from a practically smooth, continuous condition to a more or less indentate or armed condition, with prominent or large, but usually blunt, posteriorly directed tubercles. The dorsal view of the appendage shows the various forms of this edge; for example, *joana* has it developed near the base in a broad blunt triangle; in *aaroni* there is near its mid-length a small distinct beak-shaped prominence. The dorso-posterior angle of the upper part of the superior appendage is also more or less variable in the different species; usually it is a rather uniformly rounded and inconspicuous end, as in *aaroni* for example, but in *joana* it is produced posteriorly in a long triangular projection overhanging the inferior appendage. But the greatest modifications of the superior appendage are concerned with the inner surface of the upper part, below the dorsal edge discussed above. This surface is often irregularly triangular in form, the apex occupying more or less of the cleft dividing the appendage into the superior and inferior parts, as may be seen in the profile view of *sylvatica* (figure 37) for example. A number of modifications of this part occur, the most peculiar of which possibly is in *fulvicollis*, where the surface cannot be detected in dorsal or lateral views, but where a posterior view shows it as a long, narrow, ventrally directed, thorn-like body (figure 70, which compare with figure 39). In *myrthea* also this part is strikingly different from the more usual, roughly triangular form, being long and finger-shaped (see figure

47) but occupying a normal position, not shifted basally and into a ventrally directed position as in *fulvicollis*.

Nothing is known of the larva of any species.

*Key to the Males of Neoneura*¹

- a¹. First postnodal descending cross-vein forked at its posterior end to enclose a marginal four-sided cell; abdominal appendages slightly longer than tenth, thick at base, gradually constricted beyond the middle and curved toward each other in a blunt end, terminated by a black point; abdomen, 34 mm., hind wing, 22 mm. **waltheri**²
- a². Not as above.
 - b¹. Pale markings throughout bright sky blue; thorax with black adjoining mid-dorsal carina more than one-third the width of the mesepisternum; third to seventh segments with dorsum widely blue, not reduced to a line, sides black. **joana**
 - b². Not as above.
 - c¹. Pale markings bright yellow, or yellowish or greenish; black on either side of mid-dorsal carina more than one-third the width of the mesepisternum; eighth segment entirely yellow, except about the apex. **bilinearis**
 - c². Pale colors not yellow.
 - d¹. Head, thorax and basal abdominal segments above bright blue or bluish, apex of third and fourth to tenth red or reddish; thoracic dark markings reduced. **sylvatica**
 - d². Not as above.
 - e¹. Thorax with black area adjoining mid-dorsal carina at least more than one-third the width of the mesepisternum; abdomen red with black reduced or wanting.
 - f¹. Thoracic dorsal black or dark brown more or less broken into transverse lines or bars, especially noticeable along the outer edge.
 - g¹. *N. denticulata*, a single teneral male known; see figure 10, and discussion of species in text.
 - g². Black markings, if any, on mesepimeron disconnected spots; pale colors of thorax red or reddish. **rubriventris**

¹This key must be used with caution because of the already known great ontogenetic variation in colors of certain species, and the likelihood that other variations than those known at this time exist. Variations other than those due to age may also be discovered when larger material is available. All determinations made with the key should be checked by reference to both text and figures. Unless otherwise specified, the characters in the key refer to fully colored mature specimens. Absence of material renders a discussion of tenerals impossible.

²Translated from de Selys; not known to me; only a single male from Brazil known.

- g³. Mesepimeron with a distinct black stripe, pale colors of thorax blue or slaty.....**ethela**
- f². Not as above.
- g¹. Pale colors of thorax blue or slaty; abdomen about 26 mm.....**ethela**
- g². Pale colors of thorax red or reddish.
- h¹. Abdomen about 30 mm.....**mariana**
- h². Abdomen about 24 mm.....**myrthea**
- e². Thorax with black area adjoining mid-dorsal carina wanting, reduced to a series of spots, or not one-third the width of the mesepisternum.
- f¹. Dorsum of thorax with irregular, transverse brown lines or bars, other thoracic markings reduced to irregular spots; abdomen almost entirely red.....**rubriventris**
- f². Thorax not as above.
- g¹. Thorax with a series of spots or a narrow stripe or bar along the mid-dorsal carina.
- h¹. Abdomen predominantly pale.
- i¹. Abdomen clear blue with some yellowish and reduced black.....**rufithorax**³
- i². Not as above.
- j¹. Abdomen largely red, dorsum of eighth and ninth segments largely pale.....**esthera**
- j². Abdomen dull, pale; dorsum of eighth and ninth segments black.....**aaroni** (juv.)
- h². Abdomen predominantly black.
- i¹. Abdominal segment two pale above, bordered and patterned with black.
- j¹. Dorsum of head with a fairly straight, transverse bar of black through the lateral ocelli from eye to eye; metepimeron pale.
- k¹. Colors red and black; abdominal segment nine largely dark above.....**carnatica**
- k². Colors blue and black; segment nine largely blue above.....**maria**
- j². Dorsum of head with a conspicuous, more or less quadrangular, black area posterior to and including the lateral ocelli, and continuous with the extreme posterior black margin of the head as seen in dorsal view (sometimes this quadrangular black area with pale spots in it); metepimeron with traces of dark to entirely black.....**amelia**
- i². Segment two entirely dark above.....**aaroni** (adult)
- g². Mid-dorsal thoracic dark markings (except sometimes near the ante-alar sinus) and mesepimeral median dark stripe wanting.

³Known to me only from de Selys' description.

- h¹. Abdomen with black predominating, eighth segment entirely dark above. **paya**
 h². Abdomen with pale predominating, eighth segment with basal two-thirds pale above. **fulvicollis**

Key to the Females of Ten Species of Neoneura

- a¹. Thorax with much dark color, dorsum largely dark.
 b¹. Abdomen, 22 mm.; posterior border of prothorax with lateral lobes greatly developed, more produced than middle lobe. **myrthea**
 b². Abdomen, 28 mm.; posterior border of the prothorax straighter with the lateral lobes not conspicuous. **mariana**
 a². Thorax pale, dorsum irregularly marked with darker transverse bars. **rubriventris**
 a³. Thorax largely light brown, dorsum with dark on either side of mid-dorsal carina reduced to a narrow irregular line or a series of spots.
 b¹. A transverse black bar or line across the head through the lateral ocelli; a broad black line on the mesepimeron. **maria** and **carnatica**; see text on **maria**
 b². Head otherwise; mesepimeron with black markings reduced and adjacent to the sutures.
 c¹. Hind border of prothorax trilobed, the lateral lobes each with an added prominence or tooth.
 d¹. Knees black, posterior face of outer surface of femora black; black on dorsum and sides of abdominal segment nine divided. **joana**
 d². Legs pale, posterior face of outer surface of femora scarcely dusky; black or brown on dorsum and sides of segment nine continuous. **bilinearis**
 c². Hind border of prothorax trilobed, the lateral lobes simple.
 d¹. Lateral lobes low, scarcely evident. **aaroni**
 d². Lateral lobes conspicuous but not as high as middle lobe; abdominal segment nine largely dark above. **amelia**
 d³. Lateral lobes conspicuous, about as high as middle lobe; segment nine light yellow or brown above. **esthera**
 a⁴. Thorax light brown, dorsum without spots or stripes? **paya** and **fulvicollis** (both unknown)

Neoneura joana new species (Figs. 1, 2, 31, 32, 75, 76 and 99.)

Abdomen, ♂ 23 to 26 mm., average 24.2; ♀ 22 to 23; hind wing, ♂ 15 to 16.5, average 15.4; ♀ 15.5 to 17.

♂.—Genae bright pale blue. Labrum, rhinarium, nasus and frons in front bright blue; labrum with a median basal black spot; nasus with a spot on either side, reaching the base, and the base narrowly between these spots, black. Frons above and vertex bright blue, intricately patterned with black; the median ocellus is surrounded with black, posteriorly a branch from this runs back between the lateral ocelli surrounding them, except on their outer anterior sides, and continuing posteriorly onto the occipital crest, widest just behind the lateral ocelli; anterior from the median ocellus is a wide branch which at

once forms a trident, none of the branches of which reach the front edge of the frons; from either side of the median ocellus a black bar runs directly to and surrounds the antenna, from which it is produced forward and inward in one branch to the front edge of the frons, and, in a second branch, produced backward and outward against the eye, which is very widely bordered with black from this point backward; from each lateral ocellus a black bar runs outward and forward to meet the black area along the eye; this black bar may be joined to the black around the ocellus or widely separated from it; in the former case the blue area behind the bar and on either side of the median black of the occipital crest is two-branched at its outer end, one branch running forward and outward, the other backward and outward, toward the eye from which they are widely separated; in the latter case, *i.e.* when the black bar above described is separated from the lateral ocellus, the pale area behind it is joined across the gap with the spur-like pale area running outward and forward from the lateral ocellus toward the antenna, from which it is widely separated; opposite the occipital crest, and slightly posterior to it, is a very small pale spot near the eye, reduced to the merest point in one specimen; and posterior to this small spot is a short transverse pale bar, just discernible from above, which is still more widely separated from the eye. Antenna with second joint black, apex blue, remainder brown, third joint pale at base. Rear of head black, bordered with pale greenish blue against the eyes.

Prothorax black; sides and anterior border of front lobe blue, wider on the sides; middle lobe with a bright blue spot on either side occupying most of the lobe; posterior edge of hind lobe blue bordered. Propleuron with the upper half black and lower half bright blue in irregular pattern.

Thoracic colors bright blue and black, the blue only slightly paler on the sides and below.

Abdomen bright light blue and black, seen from above largely blue; basal two-thirds of segment one black; two with a wide longitudinal black bar on either side not reaching base or apex, subapically produced dorsally in a triangular spur which almost meets with the one on the opposite side; segments two to six with very narrow, scarcely discernible, basal black rings, and two to ten with apical black rings or apical black more extensive; three to seven have the longitudinal lateral black stripe like two, separated from the base as in two, but reaching the apex; the blue dorsum and the subapical blue area, defined by the dorsal development of this stripe, become progressively narrower from three to seven; the basal third or slightly more of eight is entirely blue, narrowing from this point back to near the apex of the segment, with a subapical constriction; nine dorsally black, a large quadrate sub-basal blue spot on either side; ten, black. Sides below bright blue or, on three to six, yellowish; the lateral black stripe on three to six widening near the apex and reaching the lower margin; black spot on eight of irregular pattern, longest below, but not reaching the base or the lower margin, enclosing a large subapical blue spot near its lower posterior portion, this blue spot often continuous along its lower part with the blue of the entire extreme lower border of the segment; nine with the large sub-basal blue spot described in dorsal view, and a subapical blue spot homologous

with the subapical blue spot on eight, but the sides below of nine are black to the extreme border; the large quadrate spot and the subapical blue spot may be narrowly joined at the lower posterior angle of the quadrate spot; ten entirely black, with a small blue spot near the middle—the homologue of the subapical blue spot on the preceding segments. Ventral suture black. Appendages black. Legs pale dull yellow; femora dark externally, especially on the posterior face and apically, where the inner side is black; tibiae dark on the inner side and, in the front legs, on the anterior external face; tooth on tarsal claw about as in *myrthea*.

Wings clear, in only one specimen slightly tinged; stigma brown to almost black, covering one cell or very slightly less, its costal length from slightly less than to slightly more than twice its width.

♀.—Genae cream or pale gray. Labrum yellow or light brown, paler below, a median basal black spot. Rhinarium, nasus and frons in front light brown; nasus patterned as in the male. Frons above and vertex brown, variably patterned with black; in the paler specimen the black area about the ocelli (see description of male) is reduced to a small spot just behind the median ocellus, and a spot just inside and posterior to each lateral ocellus; of the trident in front of the median ocellus only the three apices remain; the lateral bar on either side of the median ocellus is entirely gone, though the second joint of the antenna remains black; the bar outward and forward from the lateral ocellus begins about one-third the distance from the ocellus to the eye, from which point it runs directly to the eye, the entire region in front of it and immediately posterior to it, pale; a black spot on either end of the occipital crest; and outside and posterior to this is a black transverse bar as in the male, the adjoining region of the eyes narrowly black margined. In the darker specimen all the above spots and bars are present and larger, and in addition there is a dusky spot on either side of the median ocellus, and a large round spot near, but not touching, the eyes midway between the black bar from the lateral ocellus and the posterior transverse bar. Antenna with second joint black, white at apex; basal half of third joint white or pale; remainder black or dark brown. Rear of head black, pale above and the eyes broadly margined with pale.

Prothorax brown; front lobe with a posterior black spot on either side; middle lobe with a median longitudinal black line and a dusky indefinite spot above on either side; hind lobe with a large round black spot on either side, lateral margins pale. Propleuron brown, upper half paler, bordered above and in front with dusky or black.

Thoracic colors light brown and black.

Abdomen above dull blue, pale and disappearing on segment seven, and apparently wanting on eight to ten; one with basal half black; two to eight with extremely narrow basal rings, sometimes evident only as a small median spot; two to six with distinct, and seven to nine indistinct apical black rings; two to seven with a subapical black area on either side, joined in the middorsal line on two and three, narrowly separated on four to six and a little more widely on seven, the subapical pale area enclosed between this dark area and the apical ring is the same color as the color anterior

to it on the same segment, except on six and still more on seven where it is duller, becoming yellowish; eight above dull yellowish brown with subapical spots, homologous to those on the preceding segments, broadly joined on either side with a lateral stripe; nine greenish yellow, on either side a large triangular basal black spot two-thirds to three-fourths the length of the segment, dorsum of apex black; ten largely black, a small median spot and apex pale. Seen from the side in one female the dorsal blue is bordered with a black line, beginning subbasally and ending in the subapical black area, this black line scarcely evident on segment two, most distinct on three to eight; in the other female this dark border is present but less developed, scarcely evident on two and three, more or less interrupted on four and five, and on three to six narrowly separated from the blue dorsum by pale yellow; sides below pale, more or less irregularly varied with light bright yellow, dull yellow, and greenish reflections; sides of eight dull yellow, a submedian dark spot near the lower border; nine dull yellow, a basal dark spot or stripe two-thirds its length, near the lower border; lower edge of genital valves and valvular processes distinctly black; ten pale.

Legs light yellow or cream; posterior external face of the femora, their apices and the inner face of the tibiae, dusky or black.

Wings hyaline; stigma light brown, covering one cell or slightly less.

BRITISH GUIANA: all in 1912; near the mouth of the Potaro River, February 4; Tumatumari, February 4, 7, 9 and 11; Rockstone, February 14: a total of ten males, two females.

Type.—♂, February 11; ♀, allotype, February 7; Tumatumari, in writer's collection. Named for Mrs. Jane Atkinson, wife of Dr. D. A. Atkinson, a companion on numerous collecting trips to whom I am indebted for many specimens.

This bright blue and black species is as different from other *Neoneura* I have seen in life in its habits as in its colors. As we ascended the Essequibo River from Rockstone they were seen several times flying over the river far from the shores, and the first one taken came near enough to be netted when our boat was entering the Potaro River. The river at this time was in very low water stage, and on a long sand bank at the water's edge below Tumatumari the species was frequently seen. The female, attended by the male, oviposits in leaves partly embedded in damp sand, though often at some distance from the water, but where a rise of the river, if only a few inches, would submerge them. The species is as active as its congeners, and its bright blue color, with the sharply patterned black, gives it a brilliance scarcely less than some of its flaming relatives.

Neoneura bilinearis Selys (Figs. 3, 4, 5, 33, 34, 35, 36, 77, 78 and 100.)

Abdomen, ♂ 24 to 26 mm., average 25; ♀ 23: hind wing, ♂ 15 to 16, average 15.7; ♀ 16 to 17.

♂.—Genae yellow. Labrum, rhinarium, nasus and frons in front greenish yellow; labrum with a median basal black spot; nasus with a black spot on either side in front and a dusky longitudinal median stripe, the latter often wanting. Frons above and vertex with an intricate and variable pattern of greenish yellow and black. The palest pattern is as follows: each ocellus is surrounded by black, but separated by included pale lines; from the body of black about the median ocellus three bars of black arise, one anteriorly in the median line and one on either side; the median bar branches into a trident, the middle prong of which alone reaches the angle of the frons; the lateral bars from the ocellus, one on either side, run outward and forward to the angle of the frons, then backward and outward to the antenna and posterior to it where each branches, one short branch ending against the eye, the second branch, longer and narrower, ending opposite and near the lateral ocellus; directly posterior to this termination of the longer branch is a black spot at the end of the occipital crest; just posterior to the shorter branch, which ends against the eye, is a large round black spot which touches the eye and is produced posteriorly as a narrow black border against the eye; posterior to this large round black spot is a short wide transverse bar of black at the posterior border of the vertex; the occipital crest is black at the center. In the maximum black pattern the following changes have taken place: the lateral branches of the trident fuses each on its outer side with the lateral black bar from the median ocellus, leaving a small squarish pale spot included; the black areas about the ocelli, the occipital crest and against the eyes fuse with the resulting pattern in pale; a very small spot between and another on either side in front of the lateral ocelli; from each lateral ocellus a pale bar runs toward the antenna, reaching about two-thirds the distance; this pale bar at its posterior end dilated into a spot from which three branches arise, a short one running around and behind the ocellus, another running forward and outward toward the eye and the third running backward and outward toward the eye; opposite each termination of these two last branches is a pale spot nearly against the eye; the black thus bounded by these two branches and the two spots is the large round black spot against the eye, described above in the pale color pattern. Antenna with second joint black, pale at apex; third joint brown, paler basally; remainder brown. Rear of head with a yellow transverse bar above, not reaching the eye; below this a broad yellow border against the eye; remainder black.

Prothorax with front lobe black, anterior border and a large median spot, yellow; middle lobe yellow with a wide median longitudinal black band which is greatly widened at the anterior border; hind lobe black, posterior edge narrowly yellow except in the median line. Propleuron black, yellow or dusky at the extreme lower edge.

Thorax yellow and black, the yellow paler on the sides and below; only slightly variable as shown by specimens before me (see figures 3 and 4).

Abdomen black above; a wide apical yellow spot on segment one; a wide yellowish-green median longitudinal stripe on two, widening basally but not quite reaching the base of the segment, subapically constricted or divided, forming a subapical round spot; three similar, but the narrow basal black ring of segment two represented by a small median basal spot only; four similar, the dorsal stripe narrower except at the base, and the subapical portion reduced to a median line; five similar, with the median stripe still more reduced, the subapical part a vestige only; six similar, the expanded base of the pale longitudinal median stripe persisting, but otherwise scarcely discernible except at its subapical end; seven similar to six, the base yellowish-green and with a subapical median narrow yellow spot; eight conspicuously yellow with an irregular subapical spot on either side and a narrow apical ring, black, the two subapical spots sometimes joined to form an apical quadrangular spot, continuous with the apical transverse ring; nine black, a subapical yellow spot on either side below; ten black. Seen from the side, segments one and two with the lower half yellow, one with its lower posterior border more or less dusky; three to six with the lower border broadly pale or greenish yellow, progressively narrower posteriorly, especially at the apex of the segments; seven below more broadly dark yellow; eight entirely yellow, except for the apical black described in dorsal view; nine black, except for yellow spots described in dorsal view, and a ventral prolongation of these which reaches the lower border; ten black. Ventral suture black, except on eight to ten where it is dull yellow. Superior appendages black, paler basally; inferiors yellow, slightly darker apically.

Legs bright clear yellow, the posterior external face of the femora and the anterior external face of the tibiae slightly dusky, most marked on the first legs and least on the third; apices of femora, spines and the tips of the tarsal claws, black; tooth on tarsal claw about as in *esthera*.

Wings clear or slightly tinged; stigma yellowish brown or brown, covering very slightly less than one cell, its costal length equal to or slightly greater than twice its width. Of wings examined, in one case the descending cross-vein from the subnodus does not reach the wing margin, but stops at Cu_1 . All terminations of Cu_1 , A, and the descending cross-vein from the first postnodal are normal.

♀.—Genae gray. Labrum, rhinarium and nasus light yellowish brown; labrum paler below, a median basal dark or black spot; nasus with a black spot on either side and a median longitudinal dusky bar. Frons in front pearl gray, yellowish tinged. Frons above and vertex olivaceous pearl gray; two dusky spots in front of the median ocellus represent the apices of the lateral branches of the black trident of the male; below (anterior to) the antenna is a dark spot against the eye; about half way between the lateral ocellus and the eye a narrow dusky or black line starts, and runs outward and forward against the eye, which has a narrow dusky or black border posterior to this point; a dusky spot at each end of the occipital crest; outside and slightly posterior to this a short transverse dusky bar equally separated from the spot on the occipital crest and the eye. Antenna with second joint gray on its outer face, dark or black on the inner, nearly white at the apex; remainder brown, the

third joint pale basally. Rear of head light pale yellow, immediate region of the occipital foramen largely black.

Prothorax brown; front lobe with the anterior border paler, a black spot on either side posteriorly; middle lobe with a very narrow longitudinal median black line; hind lobe with an anterior black spot on either side. Propleuron brown, a dusky or black spot above on the anterior border.

Thoracic colors are light brown above and below, and on the sides light yellow to almost white, the markings black and dark brown.

Abdomen above brown; segment one paler and yellow apically; segments two to six with subapical transverse dark or black rings, which are narrowed or divided in the median line, and with the apex narrowly black ringed; the lower border of the dorsal brown more or less distinctly darker bordered; three to six narrowly pale at base; on two to six the area between the subapical dark rings or areas and the apical black rings is yellow or greenish yellow, paler on the basal segments; seven dull yellow, the dark borders of the preceding brown dorsa persisting on either side as an interrupted longitudinal black or dusky stripe, the subapical black ring represented by a subapical black spot on either side; eight dull yellowish brown, the subapical black area represented by a spot on either side about mid-length of the segment; nine with basal two-thirds black, a longitudinal median bar and the apex dull yellowish brown; ten dull yellowish brown with a little ill-defined black at base. Sides below yellowish green, growing darker posteriorly and changing to dull yellowish brown. Ventral suture black, dull on segments eight to ten.

Legs light pale yellow, unmarked; spines and tips of tarsal claws black.

Wings clear; stigma light brown, covering one cell or slightly less. In one right hind wing A is a floating vein, the apical sixth wanting. In other cases Cu_1 , A and the descending cross-veins are normal.

BRAZIL: Espiritu Santo, one male, Coll. Carnegie Museum;⁴ Poco Grand, Dec. 28, 1897, one male, Cornell Coll.

BRITISH GUIANA: Wismar, January 29, 30 and 31, 1912, sixteen males, two females.

I already have described briefly the small stream between Wismar and Christianburg⁵ where we collected, among other things, the beautiful *Diastatops dimidiata*, the shadowy *Epi-pleoneura lamina* and *fuscaenea*, and the peculiar *Cyanogomphus conchinus*. It was here also, and here alone, that we found *Neoneura bilinearis*. Just above the foot bridge over the creek was a fair sized pool with a few logs strewn about and, on the right bank, some vegetation which reached out over the water, a typical *Neoneura* habitat. *Bilinearis* is a slender, peculiarly

⁴Calvert, Ann. Carneg. Mus., vi, p. 212.

⁵Notes on Neotropical Dragonflies: Proc. U. S. Nat. Mus., 48, p. 626, (May 12, 1915).

colored *Neoneura*, but in flight and alertness it is similar to its congeners. The detailed description has been prepared because the only other published description, that of de Selys, seems to be based on badly discolored material.

***Neoneura sylvatica* Selys** (Figs. 6, 37, 38, 39 and 79.)

I have seen the three males in the Carnegie Museum.⁶ Before I had seen these specimens I could scarcely believe de Selys' description was accurate, and I thought the original material was probably faded or discolored and therefore misleading. Such is not the case, and this is certainly an odd and beautiful species, with its blue thorax and basal abdominal segments with the remainder of the abdomen bright red. The break in the two colors is abrupt, taking place at the interrupted narrow subapical dark ring on the third segment.

***Neoneura ethela* new species** (Figs. 7, 42, 43 and 80.)

Abdomen, ♂ 26.5 mm.; hind wing, ♂ 18.5.

♂.—Genae light blue or green. Labrum and rhinarium olive, the former paler and yellowish along lower border, a median posterior black spot and the sides extensively black except below. Nasus black, a small yellowish spot on either side near the posterior border. Frons in front blue or green. Head above olive or bluish, intricately patterned with black as follows: median ocellus surrounded with black with two short posterior bars inside the lateral ocelli and extending slightly beyond them, where the bars are transversely joined in the median line; from the median ocellus, on either side a bar runs outward, then forward and outward over the inner face of the second joint of the antenna; in front of the ocellus are three broad bars, one median, reaching the anterior edge of the frons, and one on each side running outward and forward to the anterior lateral edge of the frons, then backward and outward to the inner face of the second joint of the antenna; from the lateral ocellus, and narrowly separated from the black behind it, a bar runs outward and forward to end against the eye; posterior to this and also touching the eye is a large round spot; posterior to this round spot is a transverse bar of black, not quite reaching the eye, and ending at the extremity of the occipital crest. Antenna brown, excepting inner face of second joint which is black. Rear of head yellow above, remainder black with the lower part adjoining the mouth parts and a narrow margin at the eyes, pale, yellowish above, greenish or bluish below.

Front lobe of prothorax black, anterior border and a posterior spot on either side, yellowish; middle lobe olive, a wide median longitudinal line, and an oblique bar the full length on either side, the two converging anteriorly; hind lobe black, very narrowly pale margined posteriorly. Propleuron olive or yellowish, black margined above and in front.

Thoracic pale colors blue or slaty, paler below.

⁶Calvert, Ann. Carneg. Mus., vi, p. 212.

Abdomen red; segment one with a large squarish basal dorsal black spot and an oblique stripe on the sides below; sides of two yellowish, dark brown at base, this produced backward nearly or quite the length of the segment in two bars, one slightly above the lower edge, the other at about two-thirds the height of the segment; a similar single dark bar just above the narrow pale yellow lower border on three; more or less definite traces of the same on four and five; sides of eight and nine largely, and the apex of ten, dark brown, shading out above; a more or less distinct subapical dark spot on either side of the dorsum on eight and nine; median apex of ten black, shading out anteriorly, reaching nearly the base. Ventral suture black. Superior appendages black above, remainder reddish brown, lower edge darker; inferiors dull reddish yellow.

Legs pale brownish yellow, outer surface of femora dark, black on the first two pairs, shading out basally, encircling the femur apically, the angle between the anterior and posterior faces narrowly yellow; anterior outer face and inner face of tibiae of first two pairs largely black; tooth on tarsal claws well developed, larger than in *sylvatica* or *mariana*.

Wings clear; stigma brown, covering very slightly less than one cell, its length about two and one-half times its width.

Type.—Brazil: Rio Grande do Sul, (H. V. Ihering), ♂, Coll. Acad. Nat. Sci. Phila. This and one other male is the material listed by Calvert as *N. rubriventris*.⁷ Only one of the specimens, designated as the type, has been seen by me. Dr. Calvert writes that the two are identical. Named for my sister, Ethel, wife of J. E. Merriman.

Ethela, *sylvatica*, *mariana* and *denticulata* are four closely related species. In *ethela* the appendages are scarcely separated from *sylvatica*, the differences minute and possibly disappearing in a large series. The outer branch or angle of the lower part or division of the superior appendage, in interno-posterior view, in *ethela* is a symmetrical triangle; in *sylvatica* the upper edge is concave, the lower edge convex and the branch itself is narrower. The same view of the inner face of the upper part of the superior shows slight and scarcely definable differences in the two species, and there are many identical, even minute, details, such as, for example, a slight trough-like vertical depression across the surface just posterior to the lower beak-like termination of the surface, this beak-like termination resting just above and inner to the inner angle of the lower branch of the superiors, and identical in the two species. However, in this view of the appendages the upper and lower edges of the inner face of the upper part of

⁷Ann. Carneg. Mus., vi, p. 212, (1909).

the superior appendage are more convex in *sylvatica*, and form a less regular triangle than is the case in *ethela*. From the closely related *mariana* and *denticulata*, *ethela* is more distinct, the appendages furnishing specific characters. In *mariana* and *denticulata* the upper branch of the superiors is longer; in *mariana* the lower branch is rounded, the apex semicircular, not triangular as in *ethela*.

In thoracic color pattern *ethela* is strikingly like *mariana* and entirely different from *sylvatica*, but in view of the limited material available these differences must not be given too much weight; while the pattern is similar in *mariana* and *ethela* I believe that certainly the pale color of *ethela* is blue or bluish as in *sylvatica*. Material of *sylvatica* and *ethela* seen by me seems equally mature, and the strikingly blue basal abdominal color of *sylvatica* is entirely wanting in *ethela*. As the red on the abdomens of specimens is about equally intense, it is probable that the difference in the basal segments is specific and not ontogenetic. See text under discussion of *maria*.

Neoneura mariana new species (Figs. 8, 9, 40, 41, 81, 82 and 101.)

Abdomen, ♂ 28.5 to 31 mm., average 29.7; ♀ 28: hind wing, ♂ 19 to 20.5, average 20; ♀ 21.

♂.—Genae light reddish brown. Labrum and rhinarium reddish brown, labrum with a median basal dark or black spot. Nasus black. Frons in front dark shining reddish brown, darker above. Frons above and vertex colored almost exactly as in *myrthea* with only the following exceptions: in *myrthea* area between the eye and antenna is black, in *mariana* reddish brown; the reddish brown spot between the lateral ocellus and antenna is usually in *mariana* divided into two contiguous spots; and the occipital crest is reddish brown or black. In one specimen the spots are unusually large and there is an additional spot at either end of and anterior to the occipital crest, but not as far anterior as the lateral ocellus. Antenna black or very dark brown. Rear of head black, a narrow border of brown against the eyes.

Prothorax black; front border narrowly reddish yellow; middle lobe with two longitudinal reddish yellow spots on either side; posterior lobe with extreme external edge pale or black. Propleuron largely black, lower posterior border and an irregular central area reddish yellow.

Thoracic dark colors above black, with a scarcely discernible trace of red, the lateral dark markings showing but a slight trace more; dorsal pale markings dark reddish yellow, growing paler and more yellowish below.

Abdomen red; segment one basally above and on the sides, but not reaching the lower edge, black, pale color yellowish red above to yellow below, a lateral apical black spot; segment two with sides yellowish red, a

longitudinal dark area above the accessory genitalia; two to nine with narrow apical black rings, most distinct on two to six and least on eight to nine; ten narrowly black basally above. Seen from the side three has a basal black spot at the extreme inferior margin; sides of three to six bright red, shading out only slightly towards the lower border; seven to ten darker, more obscure (possibly postmortem changes), with definite black markings confined to nine and ten; nine with a longitudinal black band on basal two-thirds of the segment, separated from the lower border by an almost equally wide pale area; above this black band is a more or less distinct dark or black area of slightly greater extent; ten basally with reduced homologous areas. Ventral suture black. Superior appendages black; inferiors reddish brown varying to black.

Legs brown; femora black externally and more or less internally at apex; tibiae black lined on the anterior external face; tarsi and tip of tarsal claws, black; tooth on tarsal claw small, about as in *myrthea*.

Wings slightly tinged with brown to more deeply tinged with yellowish brown; stigma dark reddish brown, covering slightly less than one cell, its costal length equalling two to two and one-half times its width. Wing venation the most variable of any species. (See tabulation.)

♀.—Genae light brown. Labrum and rhinarium as in the male. Nasus narrowly black at base, on either side this black produced forward and inward in a broad bar reaching the anterior edge of the nasus; median area brown, dusky at the center. Frons in front light brown. Frons above and vertex light reddish brown, intricately patterned with black, probably variable, here described as in the single female taken; in front of each ocellus is a small pale area; a large body of black lies between the lateral ocelli and posterior to them, but leaving the occipital crest narrowly pale; from this body of black, back of each lateral ocellus a broad black bar runs forward and outward to meet the eye posterior to the level of the antenna; in front of the median ocellus is a five-pronged body of black, on either side a bar at the level of the median ocellus runs outward and backward to meet the bar from the lateral ocellus to the eye, on either side a bar runs outward and forward to the edge of the frons, then turns outward and backward and ends on the second joint of the antenna, and the fifth bar is median and runs directly forward nearly to the edge of the frons; at either end of the occipital crest a pale area extends outward and forward to the eye, this is dilated at either end and is homologous to the two similarly located spots in the male; posterior to this, near the extreme edge of the head, is another pale spot against the eye, extreme posterior border with a short transverse pale bar, not reaching the eye, almost concealed in dorsal view. While the head has been described above as pale marked with black, this is for convenience only, as the total black areas greatly predominate the total pale areas. Antenna with second joint pale externally and apically, black on inner face; remainder brown. Rear of head black, a yellowish border, wider than in the male, next to the eyes.

Prothorax with front lobe black, bordered anteriorly with dull yellow; middle lobe dull light brown with the median line and a large indefinite rounded spot on either side black; posterior lobe black, the outer edges and the posterior

edge medianally, broadly bordered with yellowish brown. Propleuron as in the male, with pale colors duller and brown replacing black.

Dark thoracic colors on dorsum black with a greenish cast; on the sides, black with a reddish cast; pale areas brown, paler on the sides and below.

Abdominal segment one similar to that of the male but with the pale colors brown; dorsum of segments two to ten brown, two with a narrow basal ring represented on three to eight by a small median basal black spot, and on nine and ten by a large spot which covers about two-thirds of each segment; two to eight with narrow apical black rings; two to six with a subapical oblique black ring, between which and the apical black is a pale dull yellowish area, rings and pale area most distinct on two and three, on four to six interrupted in the mid-dorsal line with the pale area growing progressively posteriorly darker, practically disappearing on six, where the subapical ring is reduced to a dusky spot on either side. Sides below with a longitudinal black stripe just above the extreme lower edge which is yellow, this yellow widest and most distinct on the anterior segments disappearing on seven, but well developed and reddish brown in color on eight; the black bar wide on nine, occupying most of the side except the extreme apex; represented on ten by obscure basal and apical shadings. Ventral suture black.

Legs brown, with less black than in the male; the external black of the femora reduced throughout, especially basally and on the third femora where it disappears in a series of round spots; the black on the tibiae also reduced, but here especially apically where on the third tibiae it disappears in a series of round spots; tarsi as in the male.

Wings clear; stigma light brown, covering slightly less than one cell.

BRITISH GUIANA: all in 1912; Wismar, January 31; Tumatumari, February 9; Potaro Landing, February 10: a total of six males, one female.

Type.—♂; Tumatumari, February 9: allotype ♀; Potaro Landing, February 10; in the writer's collection.

This species is named for Miss Mary M. Shafer, and its close relative, *myrthea*, is named for her sister, Miss Myrth Shafer, in grateful recognition of their long services as bibliographers and assistants in the "bug room."

This species, in de Selys' grouping, belongs with *rubriventris*, *sylvatica* and *rufithorax*, from all of which it is separated at once, among other characters, by the dark color of head and thorax. In the characters of both sexes it is extremely close to *myrthea*; the males of the two species may be separated at once by the long, rod-like development of the lower inner face of the upper part of the superior abdominal appendage in *myrthea*.

This large and brilliant *Neoneura* is a veritable gem in life as it flies over the pools of small shaded tropical streams and rests

in the overhanging vegetation. In my dried material the abdomen has remained a brilliant red.

Neoneura denticulata new species (Figs. 10, 44, 45 and 83.)

Abdomen, ♂ 25 mm.: hind wing, ♂ 17.

♂.—Colors teneral and obscure; genae, labrum, rhinarium, nasus and frons in front pale brown, labrum more yellowish, nasus with extensive obscure darker brown markings. Head above dull yellowish brown, marked with black as follows: a stemless trident in front of the median ocellus; a short bar forward and inward from the antenna to the front edge of the frons; a small spot behind the median ocellus and on each side on the inner side of each lateral ocellus; a short bar or spot between the median ocellus and the antenna; a transverse bar behind the lateral ocelli just in front of the occipital crest, which is produced outward and forward on either side in a broken bar or stripe to the eye; a round spot at either end of the occipital crest, more or less connected with a black transverse bar on either side, on the extreme posterior edge of the head in dorsal view, which does not reach the eye; in the large pale area, on either side anterior to this transverse bar, is a large, centrally located rounded spot. Antenna brown, second joint darker, distal extremity pale. Rear of head pale brown, black or darker about the foramen.

Prothorax pale yellowish brown with extensive obscure darker markings; front lobe with the extreme front border pale, an obscure transverse bar just posterior to this, and a posterior spot on either side; middle lobe with the longitudinal median line darker, and a large indefinite obscure area on either side the full length of the lobe, but not reaching the lateral margin; hind lobe with the posterior edge and the lateral extremities pale, remainder brown, enclosing on either side in front a transverse pale spot. Propleuron brown, darker margined above and in front.

Thorax brown, mesepisternum yellowish, tending to red, markings brown and black, obscure.

Abdomen yellow, sparsely marked, segment one with the usual dorsal basal black spot; two to six apically narrowly dark ringed; eight to ten with some evidence of dark markings.

Legs light yellowish brown, femora and tibiae with scarcely defined scattered brown spots; tooth on tarsal claw, weak, not quite as inconspicuous as in *maria*, but much smaller than in *mariana*.

Wings clear; stigma pale brown, covering slightly less than one cell, its costal length slightly more than twice its width. In the right hind wing the marginal cell posterior to the subquadrangle is divided by a transverse cross-vein near its mid-length.

Type.—Teneral ♂; Iquitos, Peru; Staudinger; Coll. Museum of Comparative Zoology. The specimen is in poor condition and only the distinct abdominal appendages justify its description and designation as a type.

Undoubtedly the color of the adult will prove to be similar to *mariana*, the head and thorax largely dark, and the abdomen

largely bright red. In the form of the appendages it is most like *mariana*, and yet definitely distinct. The most striking difference is in the lower branch of the superior appendage seen on the interno-posterior face. In *mariana* this is an almost symmetrical smooth round tubercle⁸, well marked off at its base from the upper branch of the superior; in *denticulata* the lower branch is a continuation, after an acute angle, of the lower edge of the upper part, and it is not at all a tubercle, but is a small roughly triangular plane, with the exposed sides thickened and rounded, the posterior edge (just beneath the upper part of the superior) armed near its middle with two juxtaposed black teeth. The upper branch or part of the superior is slenderer in *denticulata* than in *mariana*, and there is a small median tooth on the upper edge in the latter which is wanting in *denticulata*. The lower, internal expanded plate of the upper part of the superior is alike in both species, acute triangular in shape and moderately developed. In profile view the meeting of the upper and lower branches of the superior appendages is much more abrupt and angular in *denticulata* than in *mariana*. The specific name refers to the two minute teeth on the lower branch of the superior appendage. The gizzard has been described by Miss Higgins.⁹

Neoneura myrthea new species (Figs. 11, 12, 46, 47, 84, 85 and 102.)

Abdomen, ♂ 23 to 24.5 mm., average 23.8; ♀ 22: hind wing, ♂ 16 to 17, average 16.4; ♀ 18.

♂.—Genae dark reddish brown. Labrum black, lower border, for a varying width, dark reddish brown. Rhinarium dark reddish brown or black. Nasus black. Frons in front reddish black. Frons above and vertex black, a minute scarcely discernible reddish brown spot between the lateral ocellus and the antenna, a similar spot against the eye opposite the ocelli, and another similar spot against the eye near the extreme rear of the head; occipital crest with or without a reddish brown spot on either end. Antenna very dark brown or black. Rear of head black; a very narrow margin of dark brown against the eyes.

Prothorax black; extreme anterior border, posterior lateral margins of middle lobe, and extreme border of hind lobe, brown; a minute scarcely discernible brown spot on either side of the middle lobe at its posterior border. Propleuron with its anterior third black, posterior two-thirds reddish brown.

Thorax above metallic red black, mesepimeron largely the same color, shading at the borders into black or the darker area entirely black; the metathorax

⁸In other views a minute, dorso-internal, shining tubercle or low tooth may be detected on it.

⁹Proc. Acad. Nat. Sci. Phila., p. 137, (January, 1901).

is reddish brown, about the color of the pale markings on the mesothorax, shading into paler reddish brown below, with the dark areas black.

Abdomen largely bright red; segment one is black, with an apical dorsal yellowish red spot separated from or joined with a large apical lateral spot of more yellowish color, which in turn is separated from or joined with a still more yellow pale inferior longitudinal stripe; segment two with a narrow basal ring and two to ten with narrow apical rings black, brown on ten; nine with a large dorsal basal black spot on two-thirds of its length, this spot joined with or separate from a lateral spot of similar extent, which, on the extreme lower border, is produced posteriorly and joins the apical ring; ten basally black above for nearly half its length, the spot longest in the mid-dorsal line; sides of two above the genitalia narrowly yellowish, above this a broad black band continuous basally and apically with the black rings; three to eight with the extreme lower lateral edge very narrowly yellow, above this a black stripe the length of each segment, progressively wider from three to eight. Ventral suture black. Appendages dark reddish brown, darker at apex.

Legs black, femora paler inside basally, and tibiae externally with a light brown or yellowish line the entire length; tooth on tarsal claw small, better developed than in *esthera*.

Wings tinged with yellowish brown beyond the arculus, except in one specimen in which they are clear; they are very pale in two others; stigma brown, almost or quite covering one cell, its costal length equal to or slightly more than twice its width. In two right front wings Cu_1 all but reaches the cross-vein descending from the first postnodal. In the left hind wing of one of the same specimens there is a transverse cross-vein in the distal triangular cell posterior to Cu_1 ; and in the left hind wing of the other specimen the descending cross-vein from the first postnodal forks, the proximal branch ending against Cu_1 which continues to the wing margin, while the distal branch reaches the wing margin distally to the termination of Cu_1 , thus forming a four-sided cell.

♀.—Genae light brown. Labrum and rhinarium brown; labrum with a large median black area of indefinite pattern. Nasus black, a basal pale spot on either side. Frons in front brown. Frons above and vertex black, spotted as in the male and in addition a small spot in front of and against the median ocellus. Antenna with second joint black, remainder brown. Rear of head black, bordered with light dull yellow, this border only a little wider than the pale border in the ♂.

Thoracic colors similar to the male, only slightly duller.

Abdominal segment one similar to the male, but the pale colors are yellow, not reddish, segments two to six above dark reddish brown, this brown bordered below and subapically with black, the subapical black separated from the narrow apical ring by a wide ring of yellow or reddish yellow; on seven the homologous black areas are present, but the dorsum is light reddish or yellowish brown, unpigmented like the preceding segments; the dark borders to the dorsal color on either side of two to seven do not reach the apex or base of each segment and on the posterior segments especially are more or less separated by pale from the dorsal color; eight to ten black above, eight continuously, nine to ten except

at the apex which in each case is light reddish brown. Sides of two to eight, below the dark border of the dorsal color described above, with a longitudinal band of dull yellow, becoming reddish yellow on the posterior segments; below this yellow band on each segment is a parallel longitudinal band of black, about the same width as the pale band above it except on eight where it is not half as wide; below this black band the extreme lower edge of each segment (two to eight) is pale, light yellowish on the anterior segments, darker and reddish on the posterior segments; sides of nine largely black, reddish yellow apically; ten black at base, apical half or two-thirds reddish yellow. Ventral suture black.

Legs black, femora light gray inside, tibiae light yellowish outside.

Wings clear; stigma light brown, covering nearly one cell.

BRITISH GUIANA: Wismar, January 31, 1912; Tumatumari, February 8 and 11, 1912: a total of fourteen males, one female. Named for Miss Myrth Shafer; see remarks under *mariana*.

Type.—♂; ♀, allotype; Wismar, January 31, 1912; in the writer's collection.

This species is most closely related to *mariana* which it very much resembles in color; see remarks under *mariana*.

Under *bilinearis* I have briefly described a small stream between Wismar and Christianburg where we took a number of interesting dragonflies. One of these was this brilliant and beautiful species. At low water stage the first stream above Tumatumari on the same side of the river is a small, slow, mud-bottomed woodland stream known as Cashew Creek. On the opposite side, the left bank of the river, there is a similar stream just below Tumatumari Falls. At these two streams also we found *myrthea*.

Neoneura rubriventris Selys (Figs. 13, 14, 48, 49, 50, 51, 86 and 103.)

Specimens from British Guiana agree fairly well with de Selys' description, and their identity with *rubriventris* is established by the figures of the appendages received from M. Menger. However, a male from Pará, Brazil, collected by Professor C. F. Baker and given me several years ago, shows remarkable differences in the color patterns of the head and thorax (compare fig. 13 and fig. 14). Both Mr. Kennedy and I have studied this specimen and independently, he studying penes, and I appendages and characters in general, we have concluded that the specimens from British Guiana and Pará are specifically identical.

Abdomen, ♂ 29 to 30 mm.: hind wing, ♂ 20 to 21.

♂.—Genae dull brown, similar to labrum. Labrum, rhinarium, nasus and frons in front, dull reddish brown, the last paler; labrum with lower margin

paler, without definite pattern; nasus with an ill-defined or wanting black spot in front on either side (well defined and with a median posterior spot in specimen from Pará). The following description of frons above and vertex applies to specimens from British Guiana only; dull reddish brown, with obscure ill-defined markings; frons above with an obscure or wanting black central spot; in one specimen a large triangular pale postocular spot on either side, this spot broken into two or three smaller spots in another specimen, reduced to a vestige in another and entirely wanting in a fourth specimen; a short transverse black bar on either side of the occipital crest on the rear of the head above; usually a trace of black at either end of the occipital crest, and a larger spot opposite it against the eye. The specimen from Pará is strikingly different: the head above is reddish yellow with an extensive and definite black pattern as follows: from the second joint of the antenna a bar runs forward and inward a short distance, then curves broadly backward and inward to meet its fellow of the opposite side, forming a low broad U, which is produced forward somewhat in the median line; black between and posterior to the ocelli, but not reaching the occipital crest; a small median pale spot just behind the lateral ocelli; from the median ocellus a short bar runs outward on either side not quite half way to the eye; from the lateral ocellus, but narrowly separated therefrom, an irregular bar runs outward and forward to meet the eye at about the level of the median ocellus; posterior to this bar the vertex is entirely black with the following exceptions: a large pale spot against the eye at the level of the lateral ocellus; a much smaller spot posterior to it, against the eye and near the posterior border; and a more or less quadrangular spot in the median line, lying in front of the occipital crest which is included. Antenna dull brown; apex of second joint and basal half of third joint paler (British Guiana); second joint black on inner face and third joint not paler basally (Pará). Rear of head more or less black about the foramen, pale adjoining the eyes (British Guiana); largely black, the pale border at the eyes narrow (Pará).

Prothorax light dull brown, apparently without definite color pattern, anterior and posterior edges slightly paler (British Guiana); largely black, reddish brown as follows: anterior border; a large semicircular spot on the lower side of the middle lobe and a slightly smaller spot behind this on the posterior border of the middle lobe; and the lateral tips of the hind lobe (Pará). Propleuron light dull brown.

Thorax light and dark brown with black markings (see fig. 13 and fig. 14); in the specimens from British Guiana several or no black markings along the mid-dorsal line; in one specimen from British Guiana an abbreviated black line on the second lateral suture.

Abdomen red; segment one with a small basal dorsal black spot, and inferior lateral elongated oblique spot, and above it a smaller apical one; two with an obscure inferior lateral stripe above the accessory genitalia, and an oblique spot, sometimes wanting, on either side of the median line at about two-thirds the length of the segment, sides below at extreme apex dusky; three to six with the extreme apex black ringed, seven or eight to ten duller,

obscure, at least in dried material with more or less dark in ill-defined pattern. Ventral suture black. Appendages dull dark red, superiors tending to black above and apically.

Legs light brown with very variable markings; femora and tibiae, especially the femora, may be thickly spotted with dark, or the femoral markings may be obscure or wanting, and the tibiae may be lined with black or be without markings, except the inner side of all the tibiae, which are invariably black (British Guiana). Darker, the first and second femora black dorsally except at the extreme base; ventral apical half of first femora black; most of the anterior dorsal surface of the first and second tibiae covered with a black line; hind femora heavily spotted (Pará).

Wings clear or, in one specimen, slightly tinged with yellowish beyond the arculus; stigma light reddish brown to dark reddish brown, covering slightly less than one cell, its costal length equal to or slightly less than twice its width.

BRITISH GUIANA: all in 1912; Wismar, January 30; Rockstone, February 1; Tumatumari, February 9 and 11: a total of four males.

BRAZIL: Pará; collected by C. F. Baker; one male.

For further reference to this species see under *maria*.

Neoneura esthera new species (Figs. 16, 17, 18, 19, 52, 53, 54, 55, 87, 88 and 104.)

Abdomen, ♂ 25.5 to 27 mm., average 26; ♀ 22.5 to 23.5, average 22.9: hind wing, ♂ 16 to 17, average 16.6; ♀ 17.

♂.—Genae pale yellowish green. Labrum light or dark brownish red, paler below, a small black spot at center above. Rhinarium, nasus and frons in front and above similar to labrum or usually darker, almost black in some cases, nasus with a black, depressed spot on either side. Vertex brownish red, intricately marked with black, variable, ocelli surrounded by black, from the median ocellus a band usually runs outward and forward across the frons above, ending just inside the first joint of the antenna, this band with two enlargements, one against the eye, the other midway, and sometimes with its inner end, next the ocellus, obliterated; from each lateral ocellus a band runs to the eye, this band usually with an anterior branch along the eye to the antenna; posterior to the ocelli is a T-shaped spot, sometimes wanting, the stem very short, and directed posteriorly or sometimes wanting; on either side of this, at the end of the occipital crest, is a spot, midway between this spot and the eye is another spot, and in line with these two there is another spot against the eye; posterior to these spots on either side is a transverse bar of black which reaches the eye; rarely this bar and the two spots anterior to it, are more or less fused. Antenna brown, second joint darker with apex yellowish. Rear of head black, except a pale narrow border at the eyes.

Prothorax reddish yellow; front lobe with a longitudinal black bar on the mid-line and one on either side; median lobe with a median black line and a

posterior spot on either side, this spot opposite a larger spot on the posterior lobe. Propleuron black in front, border and posterior half reddish yellow.

Thorax red or reddish brown above, paler and duller below, in a few cases with traces of greenish, ventrally; black markings variable as follows: a more or less irregular mid-dorsal stripe, and irregular antehumeral, enlarged above, at the middle and below (where it is posthumeral), usually divided between the median and lower enlargements and nearly so in many cases between the upper and median enlargements; an inferior spot on the mesepimeron, which may be developed through all intermediate stages into a stripe for nearly the full length of the sclerite, this maximum development rare; a median round spot on the first lateral suture; a stripe on the second lateral suture, more or less interrupted below the upper rounded end: metepimeron more or less darkened in its median area.

Abdomen red, segments two to six brightest, segment one duller with a median basal black spot, and sides below, dusky or black; two with a longitudinal black or dark band, just dorsal to the accessory genitalia, and just above this a shorter sub-basal longitudinal bar, which may be fused or not, with the bar below it, base and apex very narrowly black; three to ten narrowly ringed apically with black, this obscure or diffuse generally on seven to ten; inferior lateral edge of three to six or seven black, brown, or yellow or red, variation probably due to postmortem changes; extreme ventral edge of three to six very narrowly pale yellow, more conspicuous in some specimens than in others; beginning on two is a trace of an obscure subapical lateral spot, which progressively posteriorly grows larger and more distinct, joining with the apical black ring to form on seven to nine a distinctly dark, but ill-defined apical area; seven to ten generally duller and more yellowish; apical half or more of eight and most of nine and ten sometimes largely black in lateral view, in which case ten is largely black throughout. Ventral suture black. Superior appendages black, brown at base and below; inferiors brown.

Legs light brown; femora with numerous darker brown mottlings, and apex darker, these brown markings sometimes fused to make the entire dorsal surface dark or black with the tibia dark basally, and on the ventral surface; tooth on tarsal claw minute, slightly larger than in *rubriventris*.

Wings clear or slightly tinged yellowish brown: stigma light yellowish brown to brown, covering less than one cell, its costal length not quite twice its width. In one right hind wing there is a transverse cross-vein in the triangular terminal cell behind Cu_1 . In both hind wings of another, the right hind wings of two others, and both front wings of another, Cu_1 terminates at the border with the descending cross-vein from the first postnodal; in another right hind wing Cu_1 meets this descending cross-vein just below its middle in the marginal cell. In both front wings of one specimen, and in the right front wing of another there is a short floating vein as a continuation of A; in the latter specimen, both hind wings and the left front wing, and in both hind wings in another specimen, this floating vein is continued clear across the cell. Were this condition normal it might be described as Cu_2 terminating against the next descending cross-vein after the quadrangle. In the left front wing last mentioned above Cu_2

is farther represented by a floating vein half way across the cell basal to the terminal triangular cell behind Cu_1 . In another specimen the descending cross-vein distal to the termination of Cu_1 is forked in both front wings, forming a triangular marginal cell, which is not reached however by Cu_1 . In another specimen, in the left hind wing there is a transverse cross-vein in the marginal cell posterior to the subquadrangle.

♀.—Genae very light brown, almost white. Labrum light brown with a basal median spot and on either side at the extreme edge a basal spot, black. Rhinarium, nasus, frons and vertex brown or light brown; nasus with a spot in front on either side, another posterior to this at the base, and a longitudinal median band, black; frons in front with two black spots in front of the base of the antenna; frons above usually with a large brown spot on either side of the median line. The vertex has the black pattern of the male reduced almost to extinction; the band from each lateral ocellus to the eye is represented by only the reduced distal half; there is also a small spot at either end of the occipital crest; there are some very obscure dark shadings about the ocelli, and sometimes there is a spot against the eye, opposite the spot at the end of the occipital crest, and a shortened, reduced bar of black posterior to this. Antenna with second joint light brown, almost white, with the inner face darker or black; third joint pale at base shading quickly into dark brown. Rear of head very light dull yellow.

Prothorax light brown, patterned as in the ♂, spots somewhat reduced. Propleuron light brown, dusky ringed inside the pale border.

Thorax brown, darker above, patterned similar to the ♂, reduced, variable; the mid-dorsal stripe more or less interrupted into a row of spots, each spot halved by the pale mid-dorsal carina; the stripe on the second lateral suture reduced to a spot above.

Abdominal pattern similar to the ♂, with the general color brown instead of red, sides below on two to six light dull green.

Legs cream colored, femora with two indistinct brown blotches on the body and one at base and apex.

Wings clear; stigma light yellowish brown, covering less than one cell.

In the wings examined the terminations of Cu_1 , A, and the descending cross-vein from the first postnodal are normal, in marked contrast to the conditions found in the males.

COSTA RICA: Rio Liberia, January 10, 1910, (Tristán and Calvert); Rio Medio, east of Santa Cruz, January 20 and 22, 1910, (Calvert); Rio Diria, west of Santa Cruz, January 23 and 26, 1910, (Tristán and Calvert); Rio Diria, east of Santa Cruz, March, 1916, (Alfaro); Rio Santa Barbara, below town of same name, Guanacaste, January 28, 1910, (Tristán and Calvert); Rio Morote, Guanacaste, February, 1912, (Tristán); Rio Buena Vista, Guanacaste, February, 1912, (Tristán); Rio Sipance, Nicoya, Guanacaste, February, 1912, (Tristán); Santa Domingo, Rio Corozal, Golfo Dulce, May, 1913, (Tristán): a total of

thirty-two males, fourteen females seen by me, all from Dr. Calvert who has other specimens from the same localities.

TRINIDAD: Diegomartin River, February 29, and March 7, 1912; Cunapo River, February 27, 1912; San Juan, March 2, 1912: a total of thirty-one males, eight females.

Type.—♂; Rio Medio, east of Santa Cruz, Costa Rica; Jan. 22, 1910: ♀, allotype; Rio Santa Barbara, Costa Rica; Jan. 28, 1910; in the collection of P. P. Calvert at the Academy of Natural Sciences, Philadelphia. The specific name *esthera* has been suggested by Dr. P. P. Calvert for this species in honor of Senora Ester de Tristán, wife of Professor J. Fidel Tristán, Professor Tristán having participated in the collection of the first known lot of specimens in Guanacaste, Costa Rica, in January, 1910.

This species, in de Selys' grouping, belongs with *rubriventris*, *sylvatica*, and *rufithorax*. However, its closest relative is *amelia*, from which it is distinguished at once by the paler abdomen in both sexes. The following notes on living colors have been given me by Dr. Calvert: "♂.—Eyes dark brown with blue or green reflections above, changing rather abruptly to pale green with a black pseudopupilla below, upper surface of head predominantly black with reddish lines. Thorax above rather dull red with black markings; sides pale brown with black markings at sutures. Dorsum of abdomen: posterior end of one and nearly all of two to nine bright red, most of one and ten black, the latter with a pair of red spots; articulations each with a narrow transverse black ring; sides of apex of five and entire sides of six to nine blackish, black rising to dorsum subapically, and on eight and nine meeting in the median line. ♀.—Eyes olive green above, pale green below. Colors of head and thorax pale brown with black lines and stripes. Dorsum of abdominal segments one and two pale greenish, a pair of spots on one and a right-angled U, open anteriorly, on two, brown; dorsum of three to five pale red, of six to ten pale brown; intersegmental articulations from one to two to six to seven blackish, from seven to eight to nine to ten dull lavender; three to seven have a pair of transverse subapical darker brown lines; eight and especially nine a transverse apical brown stripe; four to seven an indistinct brown longitudinal line on each side; pectus and ventral surface of

abdomen pale green, almost whitish; sternites of two to eight black or with a black median line; appendages and ventral margin of genital valves brown. Legs pale greenish, black at knees."

This is the only species of *Neoneura* known from Trinidad, where it occurs along the smaller rapid streams. In Costa Rica, however, it was taken associated with *amelia*, its nearest relative, in at least three localities.

One male, in poor condition, from Santa Domingo, Rio Corozal, Golfo Dulce, Costa Rica, is probably unusually dark. The head in dorsal view is black with three or four small obscure pale spots on either side of the vertex, the prothorax and thorax are almost entirely black except beneath; the mesepisternum has on its lower half an orange stripe, wide below, narrowing and disappearing above, there is a dull light brown stripe behind the humeral and the two lateral sutures, and the latero-ventral carina is paler brown; the abdomen is not especially dark except that eight to ten are largely black in lateral view, especially below and apically, the dorsal basal red narrowing apically and reaching about two-thirds the length of eight and nine.

Neoneura carnatica Selys (Figs. 20, 21, 22, 23, 60, 61, 62, 63, 89 and 90.)

CUBA, all in Hagen Collection: one male, three females under a separate pin label, "*N. palustris*," male with pin label "Cuba," three females each with a written pin label, "Poey, Cuba," and a printed pin label "Hagen," two with a written pin label, "8. ♀," one with "14. ♀": three males, two females under a separate pin label "*N. carnatica*," one male and one female each with a single pin label "Cuba" (the female may be *maria*), one male and one female (latter with three last segments lost) each with a large written blue name label, a written label, "Cuba, Poey," a number label, "8. ♂" and "8. ♀" in each case, and the printed label "Hagen"; the remaining male like the last mentioned, but without the large blue label.

For a discussion of this species, see text under *maria*.

Neoneura maria Scudder (Figs. 24, 56, 57, 58, 59, 91 and 92.)

Material consisting of one male and three females in the Hagen collection, under the pin label *palustris*, not attached to any specimen, by whose arrangement I do not know, all seem to me

to be *carnatica*. Similarly grouped under the pin label *carnatica* are three males and two females which also are *carnatica*, except one rather teneral female with only the pin label "Cuba," which is probably *maria*. Among the Protoneuræ Mr. Kennedy found another specimen which is really *maria*. This specimen is shrunk as though teneral, or originally preserved in alcohol. It had the abdominal color (nine and ten blue above) mentioned by de Selys as separating *carnatica* from *maria* (*maria* was known to de Selys only from Scudder's description), *carnatica* having nine largely black above. Inferring that this specimen was teneral, and detecting no structural differences I decided that *maria* and *carnatica* were ontogenetic stages in one species. However, I have later had the pleasure, through the kindness of Mr. Kahl, of studying the four males and one female of *maria* recorded by him from the Isle of Pines,¹⁰ the locality of Scudder's types. I am still unable to find structural differences for separating the two species, in fact the appendages are identical to the smallest detail, and yet I am compelled to consider them two species, in spite of this and the identical and peculiar color pattern of the head and thorax, for the red of *carnatica* and the blue of *maria* are certainly not ontogenetic (the Carnegie Museum female was taken in copulation with one of the four males and the material is certainly quite as mature as some of the red specimens in the Hagen collection). Moreover, the difference in color pattern of the apical abdominal segments is constant, one pattern always associated with red coloration, the other pattern associated with blue coloration, and there is no ground for thinking that this pattern can be ontogenetic. It may be suggested that the position here taken, and also with reference to *ethela* and *sylvatica*, is not consistent with the position taken with reference to the different color forms considered one species under *rubriventris*. In the last case but one specimen of the divergent form is known (this is true also of *ethela*, see discussion under that species), while we have in the case of *maria* and *carnatica*, a considerable series of each. Moreover, in *rubriventris* the two extremes, strikingly different as they are, may reasonably be expected to be bridged when larger series are available. If such connecting forms are not discovered, when the species is better

¹⁰Annals Carnegie Museum, Vol. x, p. 521, (1916).

known, I believe some future student may properly propose a new name for the dark form; at the present such a course is not justified. In fact, other students at the present time may criticise my position in regarding as distinct two insects, in which I can detect no structural differences. Some more acute student may yet detect structural differences, and, in the meantime, supposing even that real structural differences do not exist, I regard as specifically distinct two adult dragonflies of the genus *Neoneura*, one of which is largely bright red and the other largely bright blue.

The Isle of Pines specimens are smaller than the specimen of the same species in the Hagen collection, which is about the same size as *carnatica*. With the material before me I am unable to give characters which I think will prove constant for the separation of the females of *carnatica* and *maria*. In the female from the Isle of Pines abdominal segment nine is black above, ten yellow; in a female, almost certainly *carnatica*, in the Hagen collection nine and ten are alike yellow, but this is a character possibly dependent on age, as the Hagen specimen is less mature than the other. The Hagen specimen is one of those mentioned above as included under the pin label *palustris*. The slightly teneral female under the label *carnatica*, which is probably *maria*, has nine largely brown above with indications that the entire dorsum might become darker with age. A mature female of *carnatica* in the Hagen collection unfortunately lacks the three last abdominal segments. In this specimen the thorax is distinctly red as in the male; the thorax of the equally mature *maria* from the Isle of Pines is bluish brown above, without a trace of red anywhere. The color pattern of the prothorax may offer specific characters, but one must have a larger amount of material than I have to decide this. In the maximum black, as it is found in the Isle of Pine males, the following black areas are present: a broad longitudinal median bar on front lobe (1), a posterior lateral spot on either side of the same lobe (2), a narrow longitudinal median bar on the middle lobe (3), a posterior mid-lateral spot on either side of the same lobe (4), the lateral margins of the same lobe (5), transverse anterior narrow stripe on the hind lobe (6), an anterior spot at either end of this (7). In *maria* males from Isle of Pines, 1 is very broad, 3 is relatively broad, 5 fuses with

6, and 4 fuses with 6. The females of *maria* from Isle of Pines and the Hagen male have the areas all present, but not fused as described above. But in *carnatica* males, areas 4, 6 and 7 are entirely wanting, 3 is scarcely evident, and 1 is reduced. In the female the same is true, except that 4 may be present.

CUBA: (Ch. Wright), one male, Hagen collection; and probably one female, with pin label "Cuba," in the same collection.

ISLE OF PINES: Nueva Gerona, May 6 and 9, (J. L. Graf), four males, one female, Carnegie Museum.

In Scudder's description of *maria*, the symbol ♀ is used instead of ♂ as intended, and line sixteen from the bottom of page 188, for a *narrow lateral stripe* read a *narrow dorsal stripe*.

Neoneura amelia Calvert (Figs. 25, 26, 64, 65, 93, 94 and 105.)

The male is very variable in the amount of black on head, thorax and first three abdominal segments. Scarcely any two have the same head pattern and occasionally it is even unsymmetrical. In dark males the head above has a large, median, roughly quadrangular black area posterior and lateral to the ocelli, from which area three bars run out on each side to the eye; the two anterior bars irregular with enlargements, and rarely, in the darkest examples, more or less fused with each other, and with the posterior bar; the posterior bar more regular, formed by the extension on the dorsum of the head of the black rear. There is also a more or less trident-shaped black figure in front of the median ocellus. Reduction in black is accomplished by a reduction of the two anterior bars mentioned above, which may be narrowed or broken into spots, by pale spots appearing in the large quadrangular black area, in some cases these pale spots fusing and obliterating all this dark area but an irregular longitudinal bar on either side, and by the trident reduced to a small spot on either side opposite the antenna and midway between the antenna and the median line. The sides of the thorax and of segments one to three may be largely, or in extreme cases, entirely black, or almost entirely pale with the black on the thorax reduced to narrow lines or spots. The extent of black is certainly determined partly but not entirely by age; the Guatemalan specimens average much darker than the Costa Rican, and a

teneral male from the former locality, in the head and thoracic markings is as dark as almost any of the Costa Rican specimens. No Guatemalan specimens seen by me have the thoracic black as reduced as it frequently is in Costa Rican specimens. Specimens from San Tomas, Guatemala, are especially dark. These specimens were taken at a large spring at approximately sea-level. Structurally the males of *amelia* are most easily separated from the males of *esthera* by the inferior appendages, which are acute in profile view in *amelia* and are broader with the apex semicircular in *esthera*. A male of *amelia* from Santa Barbara has the abdomen 28.5 mm., the hind wing 18.

The female of *amelia* has the head above very variable as in the male; usually, in addition to the spots described by Calvert, there are traces of the apices of the two lateral prongs of the trident described above in the male, and there is a black spot at either end of the occipital crest. The thorax is pale with reduced black markings, and with little or no variation, as contrasted with the great variability of the male.

GUATEMALA: all in 1909, Morales, May 27; Puerto Barrios, May 28; San Tomas, May 29; Gualan, June 14; Los Amates, June 19 and 21; a total of sixty-one males, five females.

COSTA RICA: Rio Cieniguita, November 4, 1909, (Calvert); Agua Buena Creek, in forest, Holanda Farm, November 7, 1909, (Calvert); Rio Bananito, November 10, 1909, (Calvert); Rio Liberia, January 10, 1910, (Tristán and Calvert); Rio Medio, east of Santa Cruz, January 22, 1910, (Calvert); Rio Santa Barbara, below the town of the same name, Guanacaste, January 28, 1910, (Tristán and Calvert); a total of fourteen males, two females, seen by me, others in Calvert's collection.

The following notes on living colors have kindly been given me by Dr. Calvert. "♂.—Eyes reddish brown above gradually blending into pale green with a black pseudopupilla below. Upper surfaces of head (including labrum), thorax and first three abdominal segments bright red with black markings. Labrum pale luteous. Rear of head black, pale yellow along eye margins. Sides of thorax brown with black markings at the sutures. Sides of abdominal segments 2 and 3 and almost all of 4–10 black; 4–7 with a transverse basal narrow ring and a confluent mid-dorsal longitudinal line almost as long as each segment, yellow. Ventral

edges of tergites of 1-8 pale green. Hind part of 10 transversely pale brown or 10 all black.

"♀.—Eyes greenish-gray with 1 or more black pseudopupillae; darker in upper half. Body generally olive-gray, paler on clypeus and labrum. All regions of body with narrow black markings. Hind fourth of 3-6 and most of dorsum of 7-10 reddish brown, or olive-brown tinted lightly with red on 3 and 4."

Neoneura aaroni Calvert (Figs. 27, 28, 29, 66, 67, 95 and 96.)

The great variation in color due to age has been fully described by Dr. Calvert.¹¹ In addition to the original material, I have collected the species at Black Bayou, Texas.¹² In the left hind wing of one male the descending cross-vein from the first postnodal ends on Cu₁, just before the termination of the latter at the wing margin. In the right hind wing of the same specimen the terminal triangular cell behind Cu₁ has an added transverse cross-vein.

Neoneura paya Calvert (Figs. 30, 68, 69, 97 and 106.)

GUATEMALA: San Tomas, May 29, 1909; Los Amates, June 19, 1909: a total of eleven males. Unfortunately the unknown female was not taken. At the big spring at San Tomas, where the washerwomen congregate, and along the Rio San Francisco below Los Amates, this species was taken associated with *N. amelia*.

Neoneura fulvicollis Selys (Figs. 15, 70, 71, 72, 73, 74 and 98.)

I have seen the two males in the Carnegie Museum.¹³

Some Venational Characters of Fifteen Species of *Neoneura*, Expressed in Percentages.

(Based on the following material: *joana*, 10♂, 2♀; *bilinearis*, 10♂, 2♀; *sylvatica*, 3♂; *ethela*, 1♂; *mariana*, 5♂, 1♀; *denticulata*, 1♂; *myrthea*, 10♂, 1♀; *rubriventris*, 5♂; *esthera*, 10♂, 5♀; *carnatica*, 4♂, 3♀; *maria*, 5♂, 1♀; *amelia*, 5♂, 4♀; *aaroni*, 2♂, 1♀; *paya*, 5♂; *fulvicollis*, 2♂.)

¹¹Biol. Cent.-Amer., pp. 139 to 140 and 392.

¹²Ent. News, xxv, p. 446, (Dec., 1914).

¹³Calvert, Ann. Carneg. Mus., vi, p. 212.

	JOANA	BILINEARIS	SYLVATICA	ETHELA	MARIANA	DENTICULATA	MYRTHEA	RUBRIVENTRIS	ESTHERA	CARNATICA	MARIA	AMELIA	AARONI	PAYA	FULVICOLLIS
M ₂ front wing arising at or near the third postnodal		♂-5			♂-60 ♀-100										
midway between third and fourth postnodal	♂-5	♂-15 ♀-25													
at or near fourth postnodal	♂-95 ♀-100	♂-80 ♀-75	♂-100	♂-50	♂-30	♂-100	♂-100	♂-100	♂-100	♂-100	♂-100	♂-100	♂-100	♂-100	♂-100
at or near fifth postnodal				♂-50	♂-10					♀-33					
M ₂ hind wing arising at or near the second postnodal					♂-10										
at or near third postnodal	♂-100 ♀-100	♂-100 ♀-100	♂-100	♂-50	♂-90 ♀-100	♂-100	♂-100	♂-100	♂-100	♂-100 ♀-83	♂-100	♂-100	♂-100	♂-100	♂-100
at or near fourth postnodal				♂-50						♀-17					
M _{1a} front wing arising at fifth postnodal					♂-20 ♀-50	♂-5							♂-25		
at sixth postnodal		♂-40			♂-50 ♀-50	♂-100	♂-95 ♀-100	♂-20 ♀-20	♂-63	♂-30	♂-60 ♀-50	♂-75		♂-50	
at seventh postnodal	♂-40	♂-60 ♀-100		♂-50	♂-10			♂-90	♂-80 ♀-80	♂-37 ♀-100	♂-70 ♀-100	♂-40 ♀-50	♀-100	♂-100	♂-50
at eighth postnodal	♂-60 ♀-100		♂-83	♂-50	♂-20			♂-10							
at ninth postnodal			♂-17												
M _{1a} hind wing arising at fourth postnodal						♂-10							♂-25		
at fifth postnodal		♂-15			♂-50 ♀-100	♂-100	♂-90 ♀-50	♂-20	♂-10	♂-25 ♀-33	♂-30	♂-20	♂-75		
at sixth postnodal	♂-5	♂-85 ♀-75		♂-50	♂-40		♀-50	♂-80	♂-75 ♀-100	♂-75 ♀-33	♂-70 ♀-100	♂-80 ♀-100	♀-100	♂-100	♂-50
at seventh postnodal	♂-95 ♀-100	♀-25	♂-100	♂-50	♂-10				♂-15	♀-33					♂-50

EXPLANATION OF PLATES

All figures drawn by C. H. Kennedy except where otherwise indicated.

Plate IX

Diagrams of thoracic color patterns.

- Fig. 1.—*Neoneura joana*, type ♂, Tumatumari, British Guiana, February 11, 1912.
 Fig. 2.—*Neoneura joana*, allotype ♀, Tumatumari, British Guiana, February 7, 1912.
 Fig. 3.—*Neoneura bilinearis* ♂, Wismar, British Guiana, January 30, 1912.
 Fig. 4.—*Neoneura bilinearis* ♂, Poco Grand, Brazil, December 28, 1897, Coll. Cornell Univ.
 Fig. 5.—*Neoneura bilinearis* ♀, Wismar, British Guiana, January 31, 1912.
 Fig. 6.—*Neoneura sylvatica* ♂, Rio Salitre, Bahia, Brazil, November 13, 1907, Haseman, Coll. Carnegie Museum.

Plate X

Diagrams of thoracic color patterns.

- Fig. 7.—*Neoneura ethela*, type ♂, Rio Grande do Sul, Brazil, (H. v. Ihering), Coll. Acad. Nat. Sci., Phila.
 Fig. 8.—*Neoneura mariana*, type ♂, Tumatumari, British Guiana, February 9, 1912.
 Fig. 9.—*Neoneura mariana*, allotype ♀, Potaro Landing, British Guiana, February 10, 1912.
 Fig. 10.—*Neoneura denticulata*, type ♂, Iquitos, Peru, (Staudinger), Hagen Coll.
 Fig. 11.—*Neoneura myrthea*, type ♂, Wismar, British Guiana, January 31, 1912.
 Fig. 12.—*Neoneura myrthea*, allotype ♀, Wismar, British Guiana, January 31, 1912.

Plate XI

Diagrams of thoracic color patterns.

- Fig. 13.—*Neoneura rubriventris* ♂, Rockstone, British Guiana, February 1, 1912.
 Fig. 14.—*Neoneura rubriventris* ♂, Pará, Brazil, (C. F. Baker).
 Fig. 15.—*Neoneura fulvicollis* ♂, Uacaryzal, Brazil, (H. H. Smith), Coll. Carnegie Museum.
 Fig. 16.—*Neoneura esthera*, Cunapo River, Trinidad, February 27, 1912.
 Fig. 17.—*Neoneura esthera*, type ♂, Rio Medio, east of Santa Cruz, Costa Rica, January 22, 1910.
 Fig. 18.—*Neoneura esthera*, Diegomartin River, Trinidad, February 29 1912.

Plate XII

Diagrams of thoracic color patterns.

Fig. 19.—*Neoneura esthera* allotype ♀, Rio Santa Barbara, below town of same name, Guanacaste, Costa Rica, January 28, 1910.

Fig. 20.—*Neoneura carnatica* ♂, Cuba, (Poey), 1864, Hagen Coll.

Fig. 21.—*Neoneura carnatica* ♂, Cuba, under label *palustris*, Hagen Coll.

Fig. 22.—*Neoneura carnatica* ♀, Cuba, (Poey), 1864, Hagen Coll.

Fig. 23.—*Neoneura carnatica* ♀, Cuba, (Poey), 1866, under label *palustris*, Hagen Coll.

Fig. 24.—*Neoneura maria* ♂, Cuba, (C. H. Wright), Hagen Coll.

Plate XIII

Diagrams of thoracic color patterns.

Fig. 25.—*Neoneura amelia* ♂, Los Amates, Guatemala, June 19, 1909.

Fig. 26.—*Neoneura amelia* ♀, Los Amates, Guatemala, June 19, 1909.

Fig. 27.—*Neoneura aaroni* ♂, Black Bayou, Texas, May 17, 1907.

Fig. 28.—*Neoneura aaroni* ♂, Texas (Calvert, Biol. Cent.-Amer., p. 139, Coll. E. B. W.).

Fig. 29.—*Neoneura aaroni* ♀, Texas (Calvert, Biol. Cent.-Amer., p. 139, Coll. E. B. W.).

Fig. 30.—*Neoneura paya* ♂, Los Amates, Guatemala, June 19, 1909.

Plate XIV

Male abdominal appendages.

Figs. 31 and 32.—*Neoneura joana*, type ♂, Tumatumari, British Guiana, February 11, 1912.

Figs. 33 and 34.—*Neoneura bilinearis*, Wismar, British Guiana, January 30, 1912.

Figs. 35 and 36.—*Neoneura bilinearis*, Poco Grand, Brazil, December 28, 1897, Coll. Cornell Univ.

Figs. 37, 38 and 39.—*Neoneura sylvatica*, Chapada, Brazil, Coll. Carnegie Mus. (Calvert, Ann. Carneg. Mus., vi, p. 212); 39, apex of abdomen, seen directly from behind.

Figs. 40 and 41.—*Neoneura mariana*, type ♂, Tumatumari, British Guiana, February 9, 1912.

Figs. 42 and 43.—*Neoneura ethela*, type ♂, Rio Grande do Sul, Brazil, (H. v. Ihering), Coll. Phila. Acad. Sci. (Calvert, as *rubriventris*, Ann. Carneg. Mus., vi, p. 212.)

Plate XV

Male abdominal appendages.

Figs. 44 and 45.—*Neoneura denticulata*, type ♂, Iquitos, Peru, (Staudinger), Hagen Coll.

Figs. 46 and 47.—*Neoneura myrthea*, type ♂, Wismar, British Guiana, January 31, 1912.

- Figs. 48 and 49.—*Neoneura rubriventris*, Rockstone, British Guiana, February 1, 1912.
- Figs. 50 and 51.—*Neoneura rubriventris*, de Selys' Coll., drawn by M. Menger.
- Figs. 52 and 53.—*Neoneura esthera*, Cunapo River, Trinidad, February 27, 1912.
- Figs. 54 and 55.—*Neoneura esthera*, Rio Santa Barbara, Guanacaste, Costa Rica, January 28, 1910, (Tristán and Calvert).
- Figs. 56 and 57.—*Neoneura maria*, Cuba, (C. H. Wright), Hagen Coll., drawn by James Emerton.
- Figs. 58 and 59.—*Neoneura maria*, same as 56 and 57, drawn by C. H. Kennedy.

Plate XVI

Male abdominal appendages.

- Figs. 60 and 61.—*Neoneura carnatica*, Cuba, under label *N. palustris*, Hagen Coll.
- Figs. 62 and 63.—*Neoneura carnatica*, Cuba, (Poey), 1864, under label *carnatica*, Hagen Coll.
- Figs. 64 and 65.—*Neoneura amelia*, Los Amates, Guatemala, June 19, 1909.
- Figs. 66 and 67.—*Neoneura aaroni*, Black Bayou, Texas, May 17, 1907.
- Figs. 68 and 69.—*Neoneura paya*, Los Amates, Guatemala, June 19, 1909.
- Figs. 70, 71 and 72.—*Neoneura fulvicollis*, Uacaryzal, Brazil, Coll. Carnegie Mus. (Calvert, Ann. Carneg. Mus., vi, p. 212); 70, apex of abdomen seen directly from behind.
- Figs. 73 and 74.—*Neoneura fulvicollis*, de Selys' Coll., drawn by M. Menger.

Plate XVII

Hind lobes of prothorax.

- Fig. 75.—*Neoneura joana*, type ♂, Tumatumari, British Guiana, February 11, 1912.
- Figs. 76.—*Neoneura joana*, allotype ♀, Tumatumari, British Guiana, February 7, 1912.
- Fig. 77.—*Neoneura bilinearis*, ♂, Wismar, British Guiana, January 30, 1912.
- Fig. 78.—*Neoneura bilinearis*, ♀, Wismar, British Guiana, January 31, 1912.
- Fig. 79.—*Neoneura sylvatica*, ♂, Chapada, Brazil, Coll. Carnegie Mus.; (Calvert, Ann. Carneg. Mus., vi, p. 212).
- Fig. 80.—*Neoneura ethela*, type ♂, Rio Grande do Sul, Brazil, (H. v. Ihering), Coll. Acad. Nat. Sci. Phila.
- Fig. 81.—*Neoneura mariana*, type ♂, Tumatumari, British Guiana, February 9, 1912.
- Fig. 82.—*Neoneura mariana*, allotype ♀, Potaro Landing, British Guiana, February 10, 1912.
- Fig. 83.—*Neoneura denticulata*, type ♂, Iquitos, Peru, (Staudinger), Hagen Coll.

- Fig. 84.—*Neoneura myrthea*, type ♂, Wismar, British Guiana, January 31, 1912.
- Fig. 85.—*Neoneura myrthea*, allotype ♀, Wismar, British Guiana, January 31, 1912.
- Fig. 86.—*Neoneura rubriventris*, ♂, Rockstone, British Guiana, February 1, 1912.
- Fig. 87.—*Neoneura esthera*, ♂, Cunapo River, Trinidad, February 27, 1912.
- Fig. 88.—*Neoneura esthera* ♀, Diegomartin River, Trinidad, February 29, 1912.
- Fig. 89.—*Neoneura carnatica*, ♂, Cuba, (Poey), large blue label, Hagen Coll.
- Fig. 90.—*Neoneura carnatica*, ♀, Cuba, (Poey), large blue label, Hagen Coll.
- Fig. 91.—*Neoneura maria*, ♂, Isle of Pines, May 9, 1910, Coll. Carnegie Museum.
- Fig. 92.—*Neoneura maria*, ♀, Isle of Pines, August 6, 1909, Coll. Carnegie Museum.
- Fig. 93.—*Neoneura amelia*, ♂, Los Amates, Guatemala, June 19, 1909.
- Fig. 94.—*Neoneura amelia*, ♀, Los Amates, Guatemala, June 19, 1909.
- Fig. 95.—*Neoneura aaroni*, ♂, Black Bayou, Texas, May 17, 1907.
- Fig. 96.—*Neoneura aaroni* ♀, Texas (Calvert, Biol. Cent.-Amer., p. 139).
- Fig. 97.—*Neoneura paya*, ♂, San Tomas, Guatemala, May 29, 1909.
- Fig. 98.—*Neoneura fulvicollis*, ♂, Uacaryzal, Brazil, (H. H. Smith), Coll. Carnegie Museum.

Plate XVIII

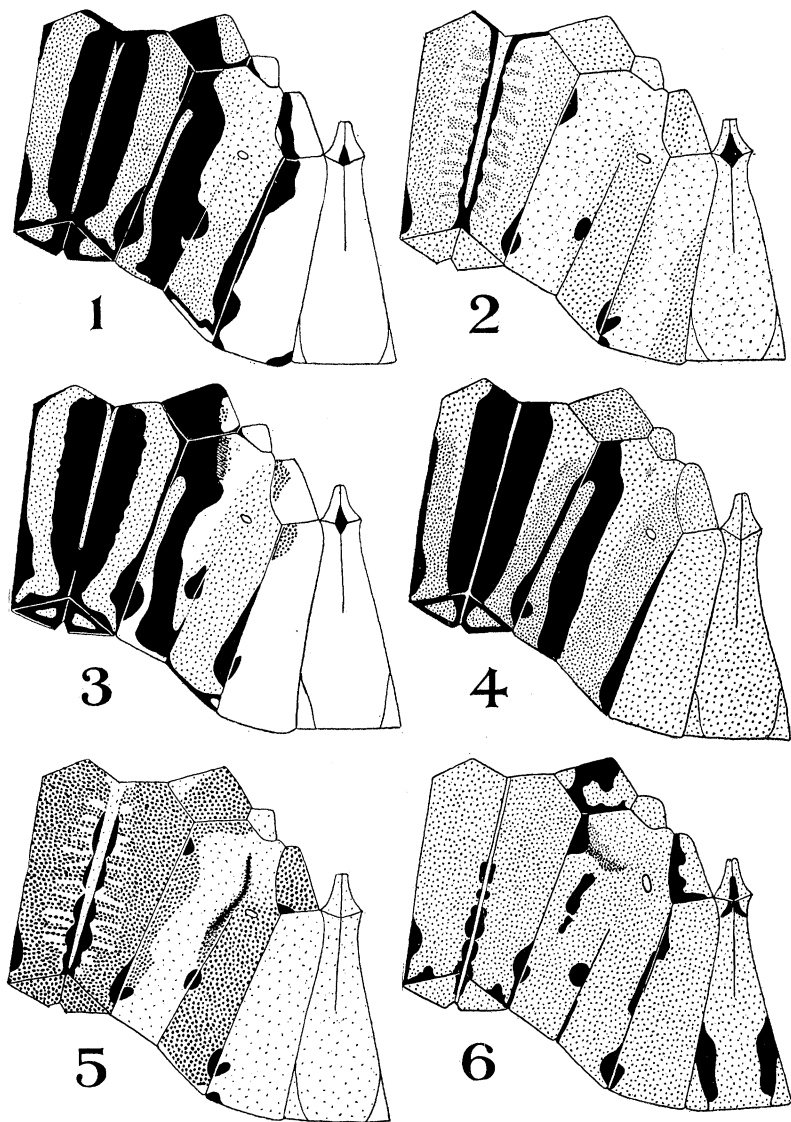
Wing photographs by Mr. Munz.

- Fig. 99.—*Neoneura joana*, ♂, Rockstone, British Guiana, February 14, 1912.
- Fig. 100.—*Neoneura bilinearis*, ♂, Wismar, British Guiana, January 31, 1912.
- Fig. 101.—*Neoneura mariana*, ♂, Potaro Landing, British Guiana, February 10, 1912.
- Fig. 102.—*Neoneura myrthea*, ♂, Wismar, British Guiana, January 11, 1912.

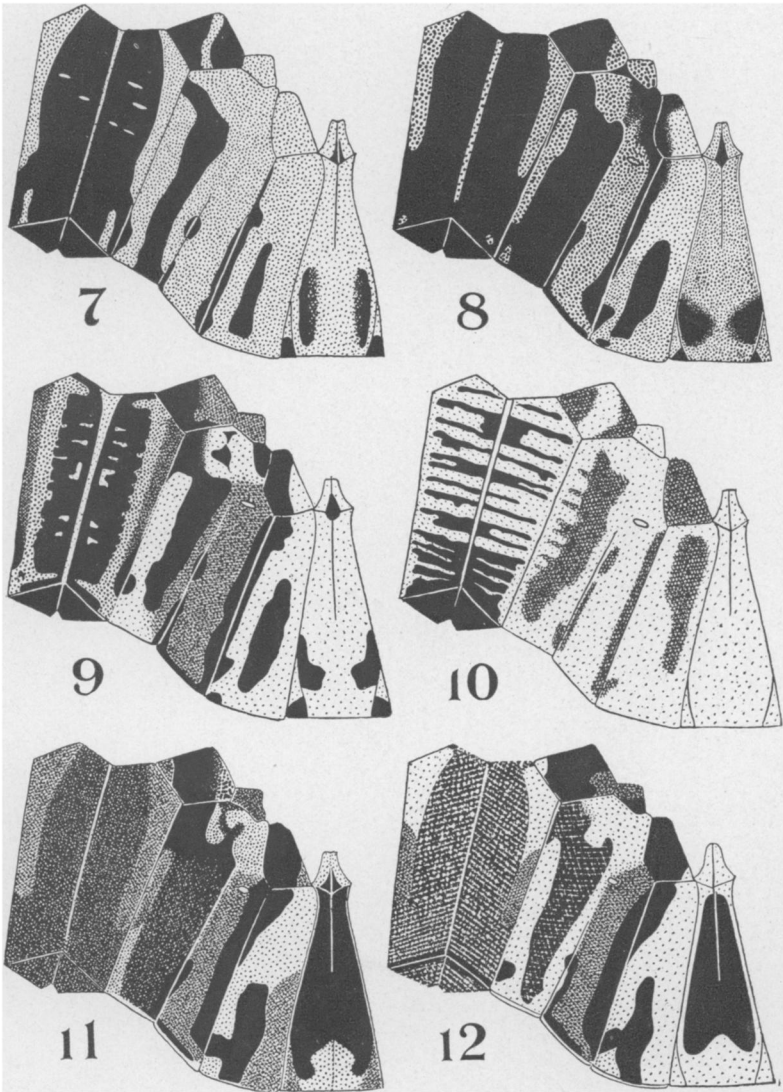
Plate XIX

Wing photographs by Mr. Munz.

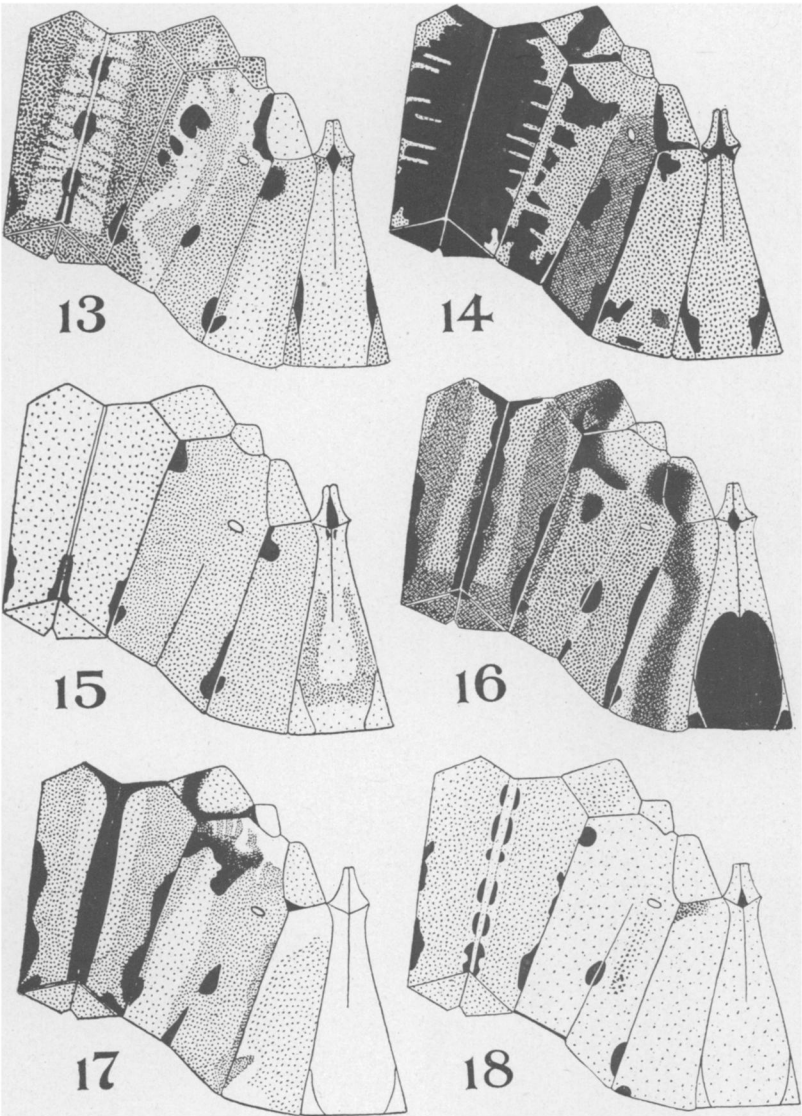
- Fig. 103.—*Neoneura rubriventris*, ♂, Tumatumari, British Guiana, February 9, 1912.
- Fig. 104.—*Neoneura esthera*, ♂, Diegomartin River, Trinidad, March 7, 1912.
- Fig. 105.—*Neoneura amelia*, ♂, San Tomas, Guatemala, May 29, 1909.
- Fig. 106.—*Neoneura paya*, ♂, Los Amates, Guatemala, June 19, 1909.



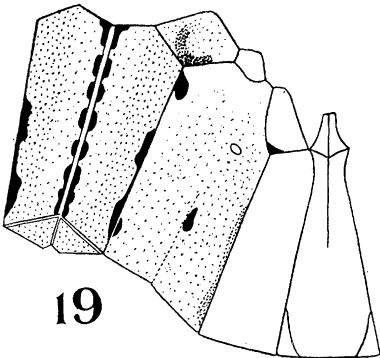
WILLIAMSON—GENUS NEONEURA



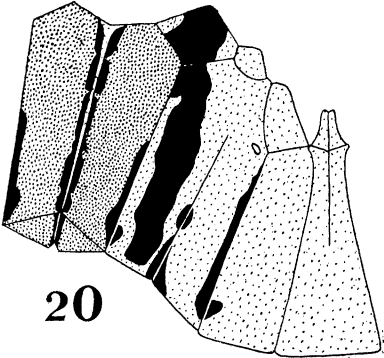
WILLIAMSON—GENUS NEONEURA



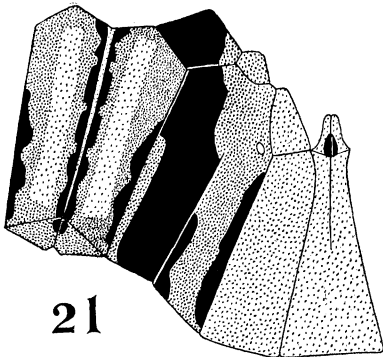
WILLIAMSON — GENUS NEONEURA



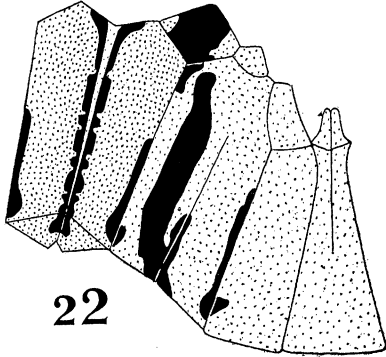
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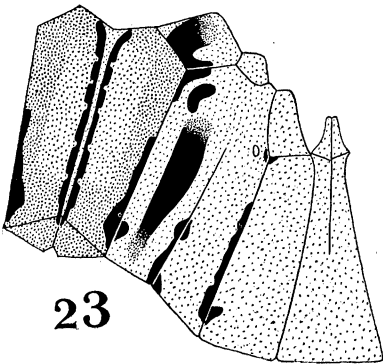
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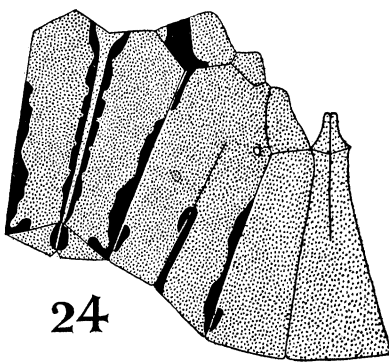
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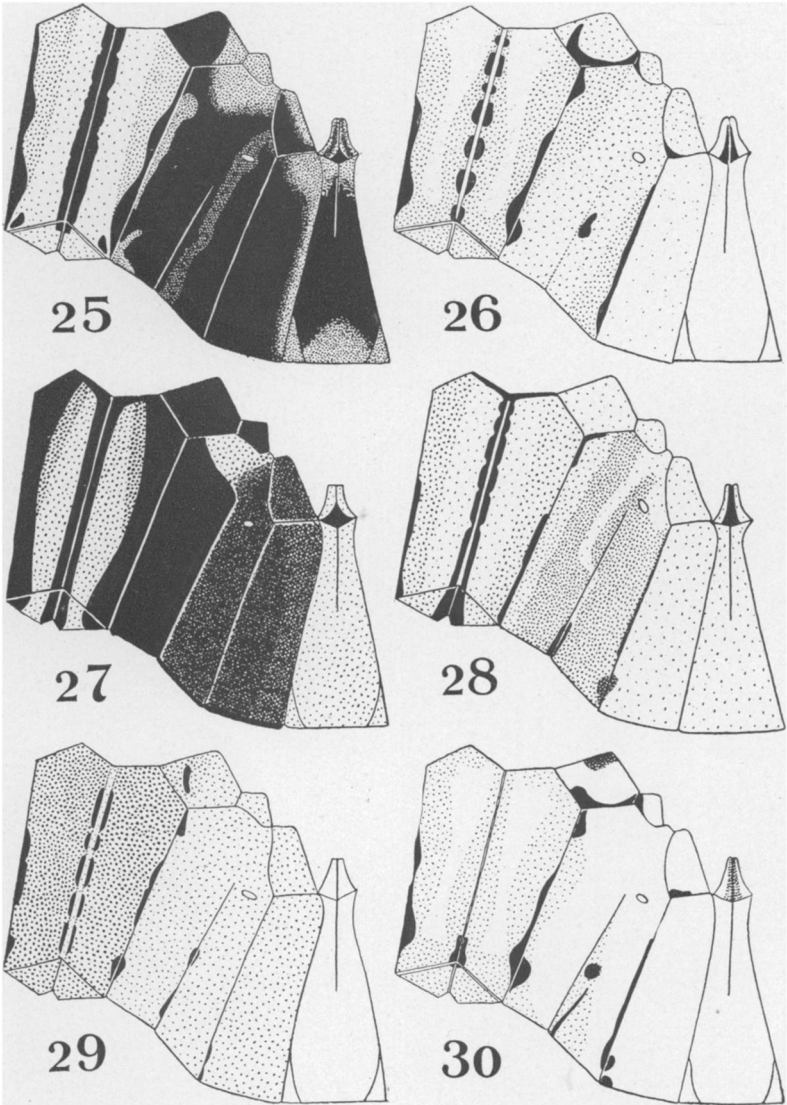
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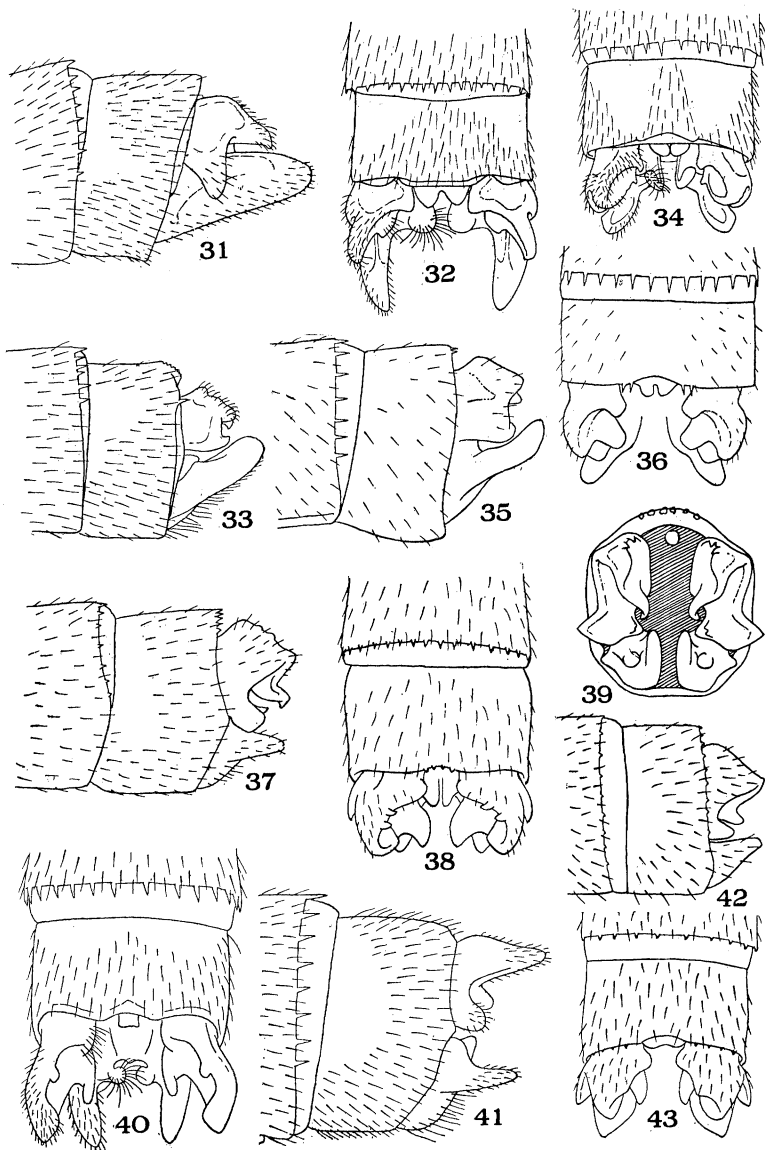
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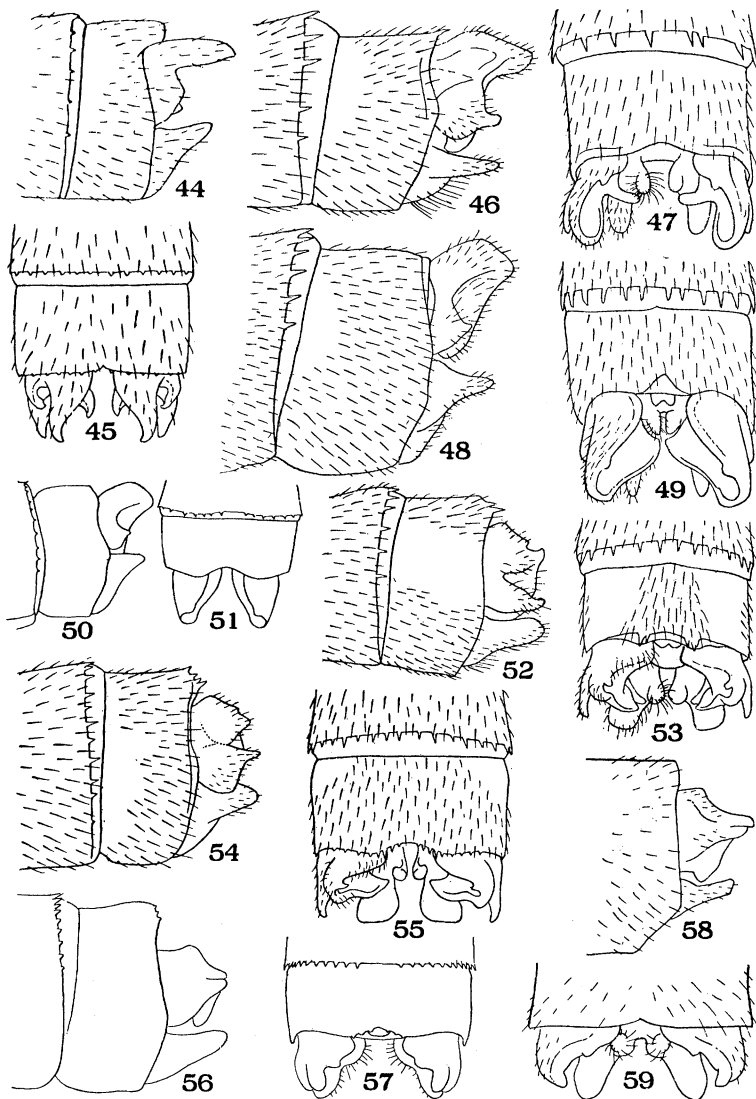


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